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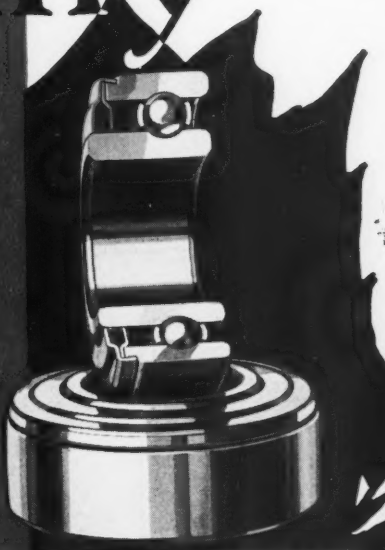

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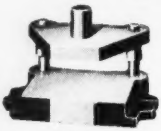

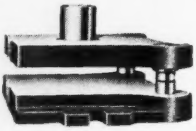

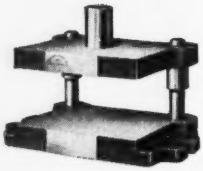

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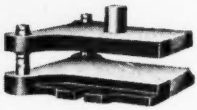

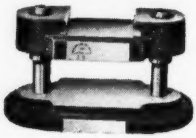

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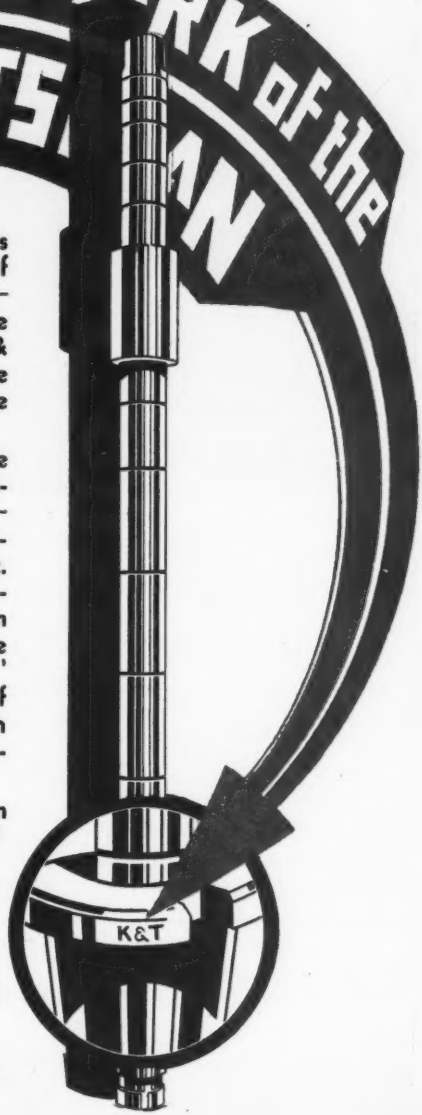

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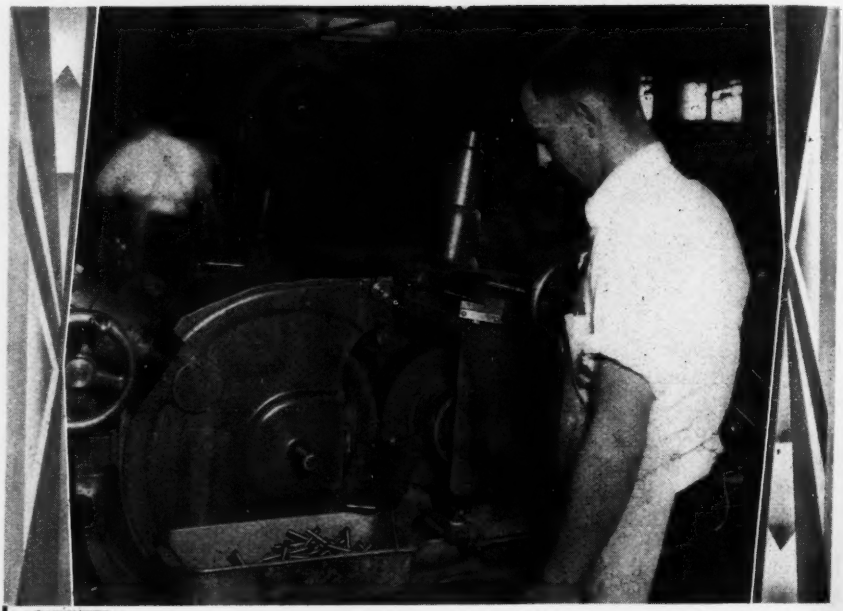

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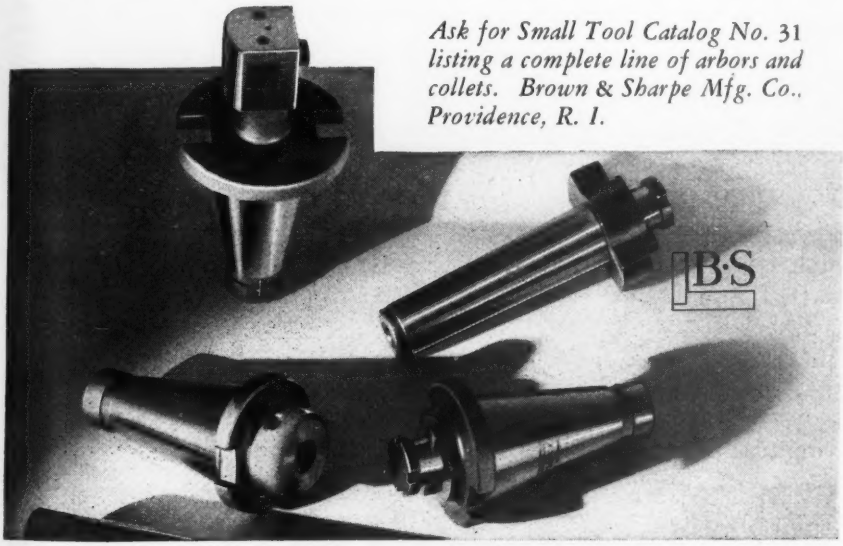

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Taper Fit in Gauge
Finish . . . . . Smooth
Wheel
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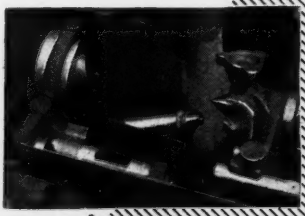
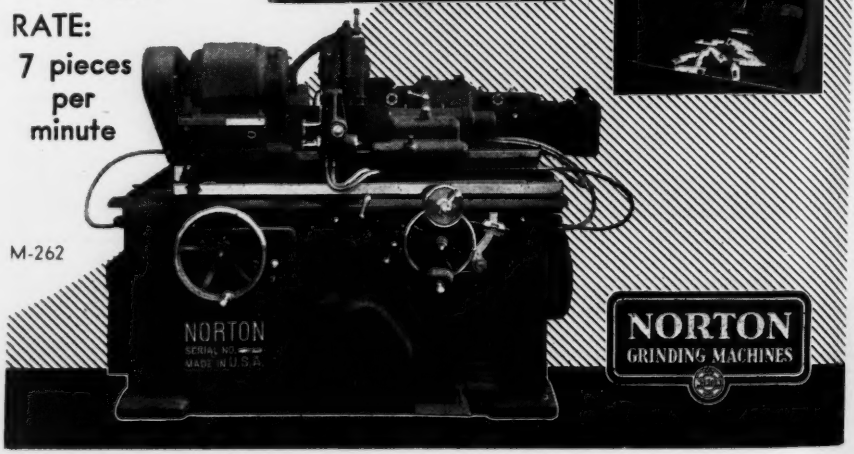
Alundum



RATE:
7 pieces per minute



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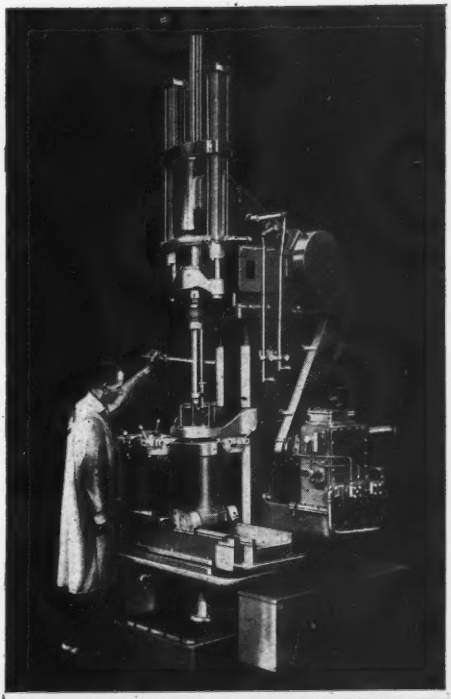
for HONING MEDIUM SIZED CYLINDERS » » »



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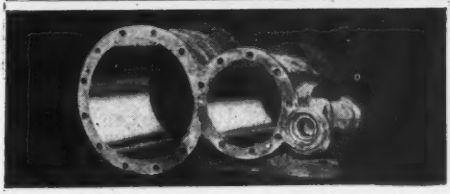

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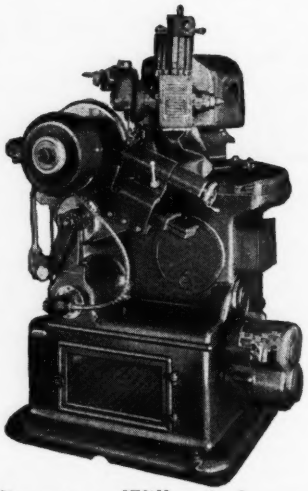
SILENT GEARS —under load



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A Magazine for Machine Shop Executives

HOWARD CAMPBELL, Editor

Vol. 3 OCTOBER, 1930 No. 5

CONTENTS

Page

MANUFACTURING OPERATIONS ON GARDNER-DENVER EQUIPMENT.....11
By Philip Winter

RESULTS PROVIDE BASE FOR RATING FOREMEN.....20
By J. J. Berliner

THE MACHINE IS NO BETTER THAN ITS CHUCK.....28
By John Marchmont

INDUCING WORKMEN TO WEAR GOGGLES NOT A NEW PROBLEM.....40
By Russell J. Waldo

SHORT-CUT FIRE PREVENTATIVES.....44
By Paul A. Bard

MODERN TOOLING PRACTICE, VII.....46
By Frank W. Curtis

IDEAS FROM READERS.....56
—PORTABLE CYLINDER HEAD GRINDER, *By H. H. Henson*
—REPAIRING A BORING MILL UNDER ITS OWN POWER, *By S. N. Smith*
—AN OVERSIZE MILLING JOB, *By Charles Kugler*
—LINK RADIUS MILLING FIXTURE, *By H. H. Henson*

OVER THE EDITOR'S DESK.....70

NEW SHOP EQUIPMENT.....72

FOR YOUR CATALOG LIBRARY.....104

"THE SCRAP PILE".....112

INDEX TO ADVERTISEMENTS.....114

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MODERN Machine Shop

OCTOBER, 1930

CINCINNATI, OHIO VOL. 3, NO. 5

Manufacturing Operations On Gardner-Denver Equipment

By PHILIP WINTER

IN the foremost rank of American industries will be found the Gardner-Denver Company, manufacturer of steam and power pumps for both general service and oil field use, vertical air-cooled and water-cooled air compressors, air-gas horizontal compressors, governors, rock drills, and drill sharpeners. This firm is a combination of the former Gardner Governor Company of Quincy, Ill., and the former Denver Rock Drill Manufacturing Company, of Denver, Colorado. The Quincy plant is engaged in the production of the heavier units such as compressors and pumps, operations in the manufacture of which will be described in this article.

The Quincy plant is of modern "daylight" construction, the outer

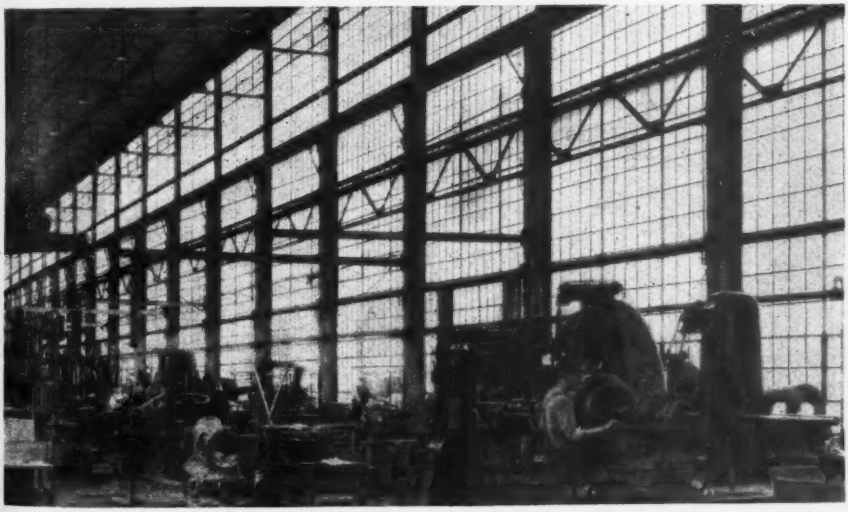
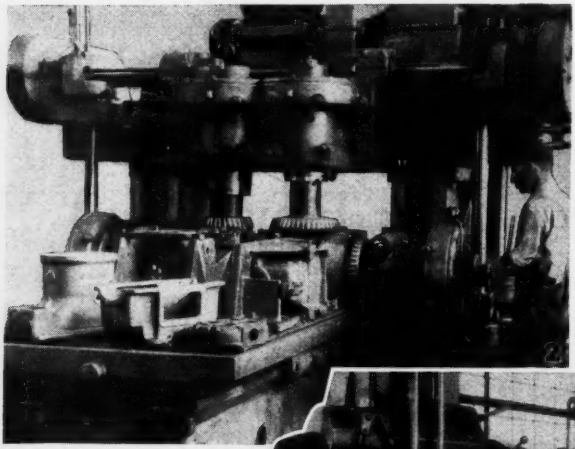


Fig. 1—Interior of Gardner-Denver Company's plant at Quincy, Illinois, showing Daylight Construction.

walls presenting an almost unbroken line of Lupton steel-sashed glass. Two 25-ton electric traveling cranes serve the heavier machines, the lighter machines being located in bays extending from the sides of the main building. The machines are set in such manner as to eliminate "back-tracking" as far as possible, although the idea of a continuous production line is impractical here, because of the diversity of products. Castings enter at one end of the shop, however, and finish at the other.



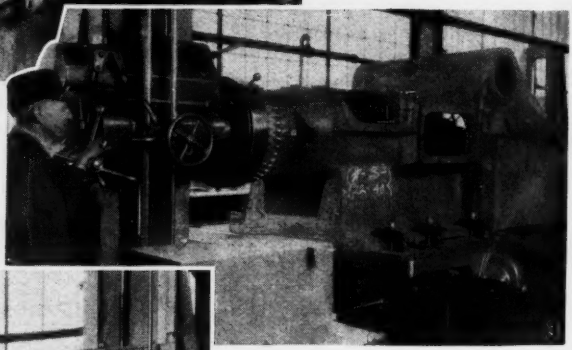
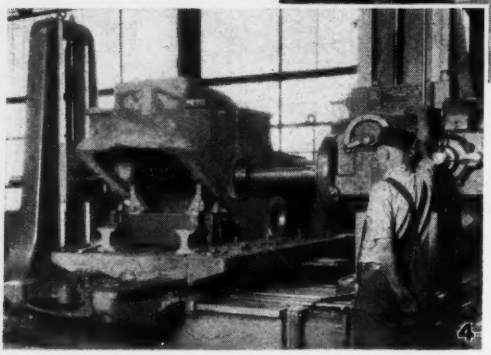


Fig. 2—One cylinder, one crankcase, and one cylinder head are each machined, top and bottom, at a cut. Fig. 3—Milling the "water" end of a pump main frame, using a 24-in., 44-tooth cutter. Fig. 4—Boring and facing power pump drive shaft bearings.



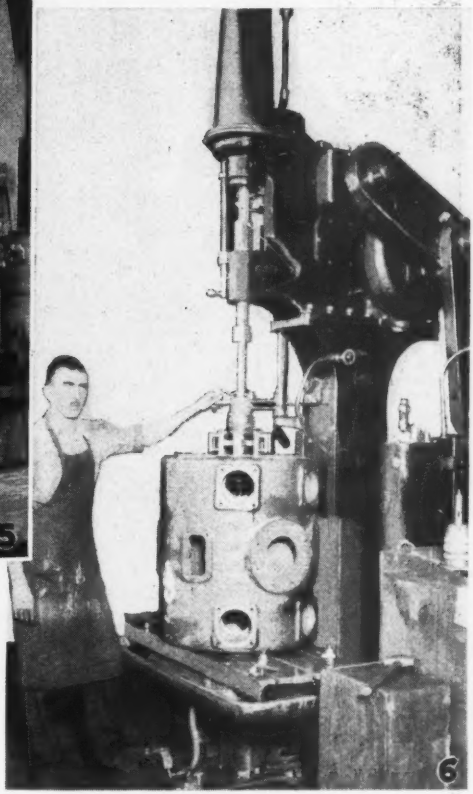
One of the more popular products of the Gardner-Denver line is the duplex vertical air compressor, which was designed primarily for direct connection to electric motors and multi-cylinder engines. The cylinders are cast en bloc, of close-grained gray iron, and the crankcases are of the same material. Inasmuch as there must be a crankcase for each cylinder, and vise versa, and as the machining time for the first operations on these pieces is practically the same, fixtures have been made up so that the top of one cylinder, the bottom of another, the top of a crankcase, bottom of another, and a cylinder head are machined at one setting. The operation, which is done on a planer-type miller, is shown in process in Fig. 2. Four inserted-tooth cutters are used, each of which is large enough to cover the entire surface on

one side. With this equipment the top and bottom surfaces of a complete cylinder, crankcase, and cylinder head are machined in 20 minutes.

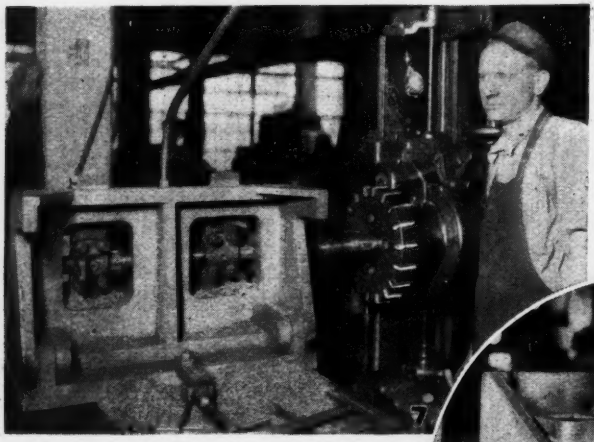
Fig. 5—Drilling twelve 1½-in. holes in the flanges of each of two water cylinders for power pump. The jig can be moved out from under the drilling head so that the crane can be used to place the pieces in the jig. Fig. 6—Using a Barnes honing machine and Hutto 8-stone grinder to finish a 10½-in. cylinder for an air compressor.

The general type of machinery built by this company is indicated by the size of the casting shown in Fig. 3. This piece is the main frame of a power pump of the enclosed, flood-lubricated type. The frame and crankcase are cast integral, the crankcase end serving as a reservoir for the flood lubricating system. This casting is also of gray iron. Here the piece is shown clamped to the table of a horizontal boring machine, a 24-in., 44-tooth milling cutter being used to finish the surface of the "water" end.

The operation shown in process in Fig. 4 is that of boring and facing the drive shaft bearings in the frame of the power pump. The piece is clamped to the table of a Giddings & Lewis No. 50 horizontal boring machine and the tools used consist of two single-end cutters and two 26-in. facing cutters. The bearings are bored simultaneously, then the facing heads are locked in position and the bearings are faced on one side, the operation being repeated for the other side.



The operation of drilling twelve 1½-in. holes in the flanges of two water cylinders for power pumps is shown in process in Fig. 5. The machine is a multiple drilling machine that is equipped with hydraulic feed.



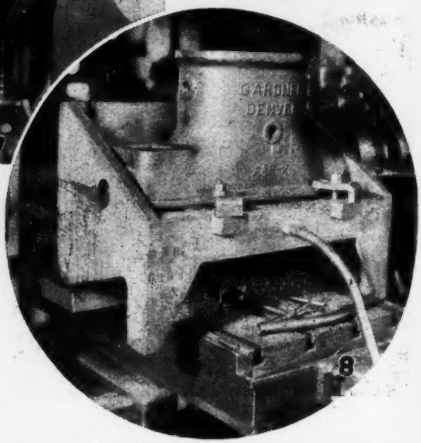


Fig. 7—Boring the main bearings in a cylinder for a vertical air compressor, using a Kelly reamer bar and a Giddings & Lewis horizontal boring machine. Fig. 8—By having the jig hinged so that it can be tipped out of line with the spindle, the boring bars or work can be changed without having to feed the table clear of the spindle.

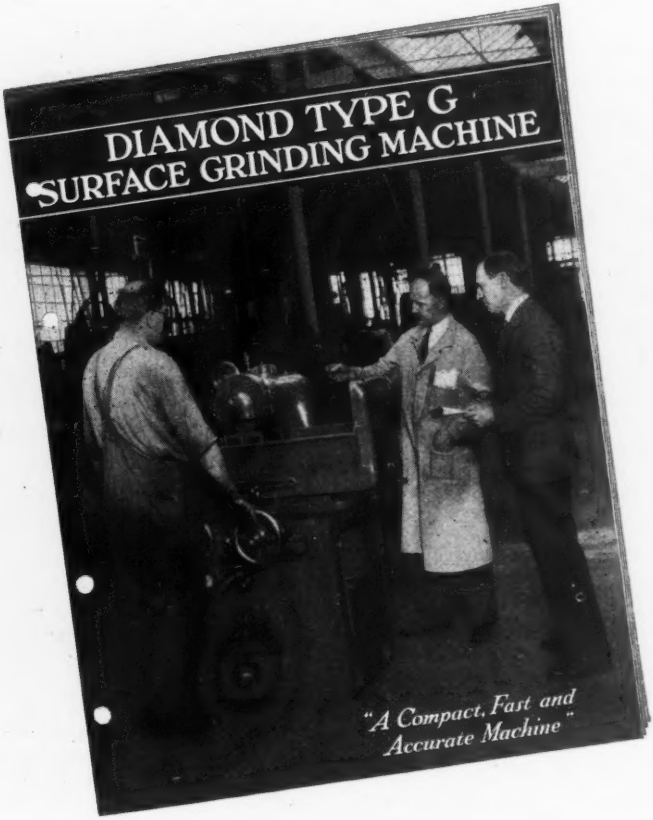
The pieces are held in position by a jig which rides on wheels on a track; thus the traveling crane can be utilized to place the pieces in position in the jig and remove them again, the operator being required only to shove the jig into place under the drills.

The progressive attitude of this company and its executives is indicated by the equipment of comparatively recent design that is found in this plant. An example is the Barnes honing machine shown in Fig. 6, set up with a Hutto 8-stone grinder to grind out a 10½-in. high pressure cylinder for a horizontal air compressor. The bore in this cylinder is 18 inches long and contains .004 inches of excess stock which is left for the grinder to remove. The bore is finished to 10.500 ±.00075 in. in 15 minutes, complete, and a surface is left which is not only accurate and true, but is also glass-smooth.

In Fig. 7 the cylinder for a vertical air compressor is shown set up on a No. 0 Giddings & Lewis horizontal boring machine to have the main bearings bored out. The tool is a Kelly reamer bar. The interesting feature of this job is the construction of the jig, which consists of a base plate that is bolted to the machine table, and the jig proper, which is hinged to the base plate so that the boring bar can be inserted through the bearings without the necessity of feeding the table out of line to clear the machine spindle. When ready to change bars or workpieces, the operator disengages the bar from the spindle of the machine, then tips the jig forward as shown in Fig. 8, clearing the spindle so that the bar can be removed from the finished piece and inserted in the new piece. After the bar has been placed in position, the jig is tipped

(Tear out this page, clip it to your letterhead, and mail it to us. We will send full information.)

A New Machine—A New Bulletin



Bulletin 635, just issued, completely illustrates and describes this new hydraulic surface grinding machine. For *your* copy write to

DIAMOND MACHINE COMPANY

"Grinding Machine Specialists"

17 CODDING STREET PROVIDENCE, RHODE ISLAND

back into line with the spindle again and the bar is engaged as shown in Fig. 7.

Three bars are used, one for roughing, another for finishing, and a third for facing the ends of the bearings. Approximately $\frac{3}{16}$ in. of stock is removed with the roughing bar, leaving .022 in. of stock for the finisher. The finishing cutters ream the bearings to drawing size, within a limit of ±.001 inch. After the bearings have been faced to length within limits of +.005,—.000 in., bronze backed bearing shells are anchored in place. The bearings are then given a final boring, a Kelly bar being used to finish the bearings to 2.250 with an allowance of ±.0005 inch.

(To be concluded in November issue)

Hacksaw-ology

A HACK SAW blade should be well strained in the frame. The proper strain or tension is important to insure true cutting and to prevent breakage of blades.

Insert saw in frame with teeth pointing forward, or away from the operator. Be sure that the blade is perpendicular and tight. Material to be cut should be held rigidly and should be placed so as to engage the maximum number of teeth throughout the cut.

Start the cut easily, using the same motion as in filing. Be sure to apply enough pressure so that the teeth will cut and not slide or slip over the surface of the metal. If the saw is allowed to rub without cutting, the cutting points will quickly become glazed and blunt. After the first few strokes, retighten the saw in the frame.

At the end of the forward stroke, lift the saw slightly to avoid dragging or rubbing the teeth on the stock during the return stroke.

From 40 to 50 strokes per minute is the most efficient speed for hand cutting. A job will be finished at this speed quicker than when taking 60 to 70 strokes per minute, and the life of the saw will be prolonged. If you wish to cut fast, operate at a slower speed and apply more pressure.

For thin metal, a saw blade should be selected with teeth fine enough so that two or more teeth will be engaged in the work at the same time. If the spacing of the teeth is so coarse that the metal catches between the teeth, the tendency will be to strip the teeth. The stock should be well supported in the vise. If possible, sheet stock should be held between two pieces of wood and the metal and wood sawed together. This is essential if bending and distortion are to be prevented.

Tubing should be cut with a special blade, having very fine teeth and tempered especially for cutting thin tubing.

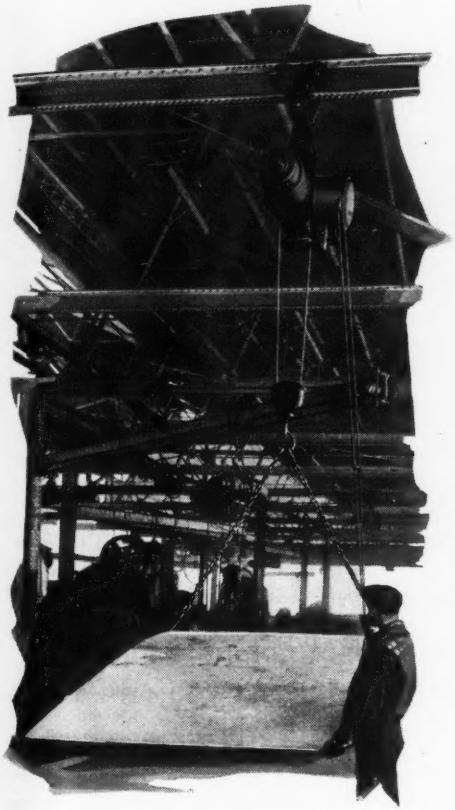
—From "Hacksaw-ology," published by Simonds Saw & Steel Co.

ALVAN T. SIMONDS, President, Simonds Saw and Steel Company, says "Business sentiment is much more cheerful, as it has reason to be. Fear, always greatest at the extreme low point of the cycle, is giving way to confidence. Business will doubtless move up slowly from now on."

In the "New York World," August 17th, Henry Ford gave it as his opinion that the country has ceased being sick and is now well and active again, but that people do not know this. Harvey S. Firestone says that the present slump in business will soon be succeeded by greater prosperity than America has known for ten years. Ford backed up his opinion by putting 100,000 workers back on the job. If every industrial leader who thinks that business should "snap out of it" will follow suit, the depression will cease to exist.

Unwieldy loads are handled with ease

by Shepard Electric Hoists



ONE hand does the lifting, no matter how clumsy the load, when a Shepard acts as a helper. Up a fraction of an inch, or the full height of lift . . . every motion is under perfect control of the operator. Load handling is always faster, more economical and easier with a Shepard Electric Hoist.

And the service of a Shepard is lasting. The "balanced" drive runs smoothly in a bath of oil. Total enclosure excludes dust, dirt and corrosive fumes from the working mechanism. Maintenance is reduced to a minimum.

There are numerous places in every plant where these untiring helpers should be helping to cut handling costs. Some typical applications are given in the "Book of Illustrated Economies." You may find some helpful suggestions within its pages.

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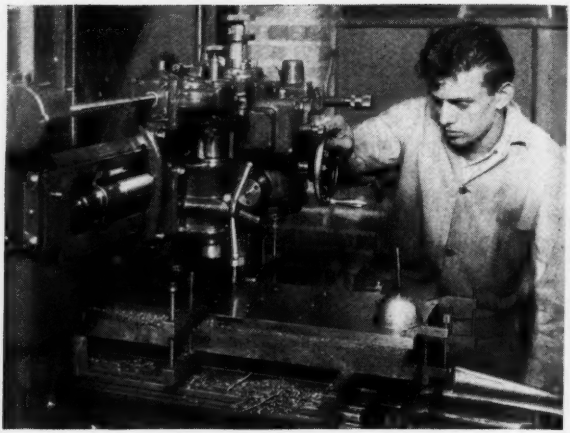
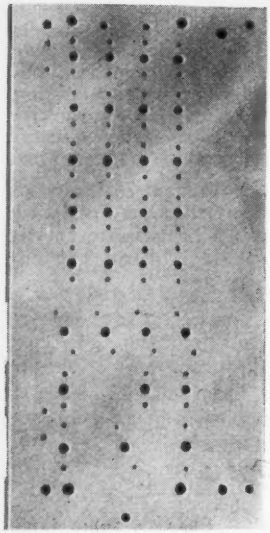
THE MOST COMPLETE LINE OF CRANES & HOISTS IN AMERICA

On This Job . . .

— the Kobzy Tool Company of Chicago, Ill., manufacturers of tools and dies—





Part: Ketos Oil Hardening Tool Steel Jig. Size: 6¼" x 3½" x ⅝". Operation: Drill and ream 64 holes 0.090 inch. Drill, bore and ream 46 holes 19/64 of an inch. Time: 14 hours. Limits: ±0.0002 of an inch.

Saved 33 hours out of 47

WITH THE

SWISS JIG BORER

ON THIS JOB of drilling 110 holes in a tool steel jig, accuracy is the first consideration. And, to get the necessary close accuracy, it required 47 hours to do the job by the former method used.

The Swiss Jig Borer does the work in 14 hours—a saving of 33 hours or 70 per cent of the former time. The Kobzy Tool Company now have three Swiss Jig Borers in operation.

You cannot compete in the tool game unless you own a jig borer!

The Swiss Jig Borer, made by the Societe Genevoise, is the outstanding machine for accuracy and speed. Ask for the new catalog No. 546 on the four larger sizes or request details on the number 3 machine—capacity 16" x 12".

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AS EASY AS A RADIO DIAL

— and as simple to control. You will be amazed at the unusual ease of table movement on the No. 2 Cincinnati Cutter Grinder. With your finger tips on the knurled control knob — a gentle twist and the table moves almost without any effort.

You get this sensitive, easy movement whether you are grinding large or small—heavy or light cutters. You turn the knob for short strokes of the table, so desirable when you want to sharpen small, narrow, intricate cutters or face mills. On the ordinary cutter grinding job, such as a spiral mill, a mere touch of the hand on the table moves it past the grinding wheel. It is so easy you will find it a pleasure to sharpen your cutting tools. The anti-friction support for the table—an innovation in machine tool design—insures not only ease of operation, but the maintaining of precision alignment.

See one in operation—move the table! You will at once recognize the value of this new feature in terms of new speed, new ease, and new accuracy for cutter grinding.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI, OHIO, U. S. A.

Results Provide Base For Rating Foremen

By J. J. BERLINER

MANY and various systems have been devised for the purpose of obtaining an accurate check on the ability of the workmen, mostly for the purpose of paying the workers according to their ability to produce. The efficiency of the foreman, however, is in most cases judged by his ability to maintain production according to requirements and keep his department running smoothly. Very often the rating accorded a foreman is entirely superficial and may be tempered to an unwarranted degree by his personality, his ability to "sell" himself to his employers, or the personal regard of the official to whom he reports.

It is always possible to maintain production if one can have enough men and equipment; it is always possible to keep the workmen satisfied and make up for a lack of real leadership if the time accorded for setting up machines, making repairs, and performing other non-productive labor is unlimited. Countless hours have been turned in as time for repairing or cleaning machines which should have been charged to indifference on the part of the foreman and lack of initiative, energy, or foresight in planning ahead for stock or tools or in placing the idle workmen on productive work in other departments.

The Monroe Calculating Machine Company has gone to considerable lengths to eliminate uncertainty and obtain an accurate check on the ability of the foremen by the use of a system which provides ratings for the various factors of most importance; viz., Efficiency of Department Operators, Idle Time, Set-Up Time, Repairs, Scrap and Department Labor. The six items are accorded ratings which altogether total 100. The system has been productive of excellent results thus far, due undoubtedly to the fact that each foreman knows that, while poor reports show up his inefficiencies, good reports are just as quick to tell the truth and cannot help but recommend him to his superiors.

The ratings accorded the six items included in the efficiency report are as follows:

Operator Efficiency	50
Idle Time	12½
Set-Up Time	12½
Repair Time	10
Scrap	10
Department Labor	5
	100

As the maintenance of a high ratio of production is considered to be the most important of the functions which are included among the duties of the foreman, half of the total number of credits are assigned to this item. In figuring the efficiencies of the operators, the hours earned in a department are divided by the actual number of hours worked. For example, if a department produces 120 per cent of standard output in a given number of hours, then the amount filled in on the report would be 60, or half of the total efficiency. Standard output is, of course, based on actual time-studies.

Idle time is time lost through any cause whatever for which the com-

HIGH SPEED • Multiple Drilling

5500 RPM 13 SPINDLES 1/4" MININUM CENTERS

INDEX announces another high standard of production, this time in multiple drilling of small holes . . . 5,500 r. p. m. . . . one to thirteen adjustable spindles . . . ¼" minimum centers . . . $\frac{3}{16}$" chuck capacity . . . a new facility of spindle set-up . . . hand lever or foot treadle operation . . . *motor in head* . . . with coolant pump electric driven by separate motor.

Range of work of the Boley HI-SPEED Multiple Drill includes production on cash registers, adding machines, radios, clocks, meters, automotive parts, locks, etc., etc., and it is efficient in metals, bakelite, micarta, formica, rubber, wood and other materials or compositions.

5,500 r. p. m.! Just the machine you have been looking for.

OTHER SPECIFICATIONS

Minimum center distance between holes, ¼"; Drilling table 7" x 10"; Table lift, hand 2¼", foot 1⅜"; Maximum distance between table and collet, 12"; Frame area, circular 5¾", rectangular 9" x 5¼". May be furnished for bench mounting if desired.

Write for further data and prices

INDEX

INDEX
MACHINERY CORPORATION
CINCINNATI OHIO

pany has to pay. Two points are charged against each hour of idle time turned in; thus, if a department turns in a total of five hours idle time for the week, 10 points are charged against the 12½ which are allowed, leaving 2½ points to be credited.

Set-up time is figured on the same basis as idle time, excepting that in some departments an allowance is made for set-up men. If two set-up men were allowed to a department, on a basis of 48 hours per week, the allowance would amount to 96 hours. Then if the department were to turn in a total of 100 hours for setting up machines, it would be charged with four surplus hours at a rate of two points for each hour, or a total of eight points. Deducting the eight points from 12½ leaves a credit of 4½ points.

Repairs are charged against each department at a rate of one point for each dollar paid out for time spent in re-processing or repairing work that has been processed in this department. Thus, if $12 worth of time is spent in one week in repairing work that has been machined in a certain department, 12 points are deducted from the 10 points allowed to the department, leaving a debit of two points. Incidentally, the charging of repairs is left entirely to the discretion of the chief inspector, and such charges are made on the repair ticket shown in Fig. 1.

MONROE CALCULATING MACHINE CO.

Repair Ticket

PART No. REPAIR ORDER No. R AMT.

CHARGE TO DEPT. No. DATE

In space below fill in operations necessary for repair only.

OP. No.	OPERATION	DEPT.	DATE	STAND-ARD	AMT.
1					
2					
11					
12					

Sign.....

Do Not Make Out Sent-Ahead Tickets

Send this copy along with work. Return to cost department when work is finished. Signature of foreman responsible for repairs.

Fig. 1—Repair ticket

The repair ticket is self-explanatory excepting for the notation "Charge to Dept. No." In this space the inspection department notes the name of the department responsible and the name or number, or both, of the operator who spoiled the work. This ticket accompanies the work that is

Increase PRODUCTION of Shaper Work

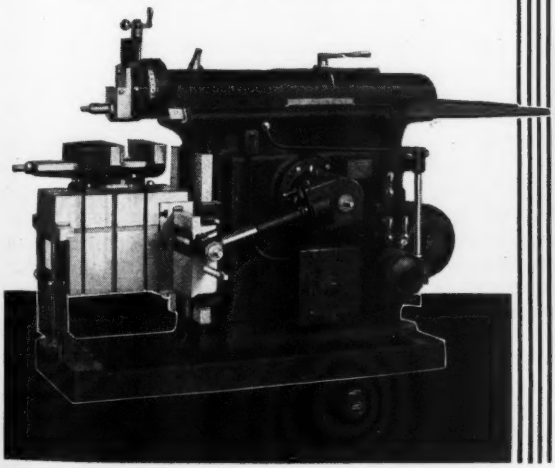
Rockford Hy-Service Shapers are accurate, powerful, durable—high grade tools which sell at a remarkably low price because no expensive but seldom used conveniences are included in their design.

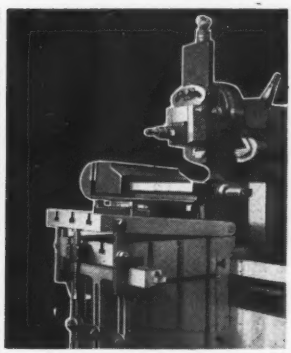
Illustrated are three accessories for Hy-Service Shapers which save much time and increase production of work having surfaces not at right angles to each other. These were built at the request of Hy-Service Shaper users and have demonstrated their practical value by paying for themselves many times over in actual service. They are standard equipment which can be ordered with Hy-Service Shapers as extras. Their cost is remarkably low—like that of Hy-Service Shapers. If you have enough Shaper work to require one or more of these accessories, even for part-time operation, you will find their purchase a very profitable investment—like that of Hy-Service Shapers.

Write today for complete details

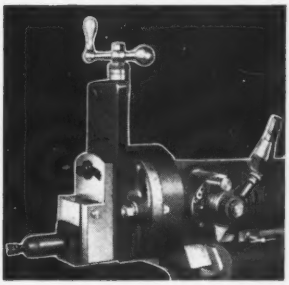
ROCKFORD MACHINE TOOL CO.

2414 KISHWAUKEE STREET, ROCKFORD, ILLINOIS, U. S. A.





TILTING TABLE-TOP—Has screw adjustment above horizontal only. Clamps rigidly in any adjustment.



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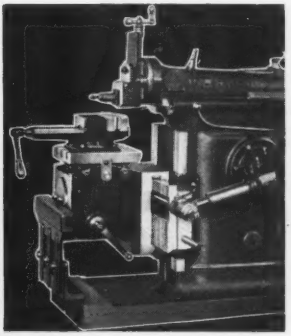


UNIVERSAL TABLE—Tilts and Rotates. Adjustable quickly, clamps securely. Outboard support is exceptionally rigid.

to be repaired on its travels through the shop, and when the amount of time required to do the repairing is filled in on the time ticket by the clerk, a notation is made on the repair ticket, next to the order number, showing the operator and department to be charged. This procedure makes it an easy matter for the time department to take off the various charges.

The charge for department labor or "house service" covers time allowed for cleaning machines, making minor repairs to equipment, and so on. Each department is allowed a certain amount of time per week for this purpose and as soon as the allotment is exceeded, each hour is charged for at the rate of one point for each hour. Thus if a department should turn in

MONROE CALCULATING MACHINE CO.

Scrap Ticket

No. S..... .....193...

PART No.	OPERATIONS COMPLETE	AMOUNT SCRAPPED
DEPARTMENT RESPONSIBLE	OPERATOR RESPONSIBLE	OPERATION RESPONSIBLE
ORDER No.	VALUE OF SCRAP	

ORIGINAL .....

Fig. 2—Scrap ticket.

Scrap is charged against the department at the rate of 1 point for each dollar of time spent on scrap. The charging of scrap is also left to the chief inspector. A copy of the form used in charging scrap is shown in Fig. 2. Each operator is personally charged with all scrap (likewise repairs) made necessary by his or her carelessness. The charge is for labor only, however, the company taking the material loss. The charge is limited to a certain point, due to the fact that the plant is operated on a standard time basis and the operator is guaranteed 48 hours' pay at the rate of hire. Therefore the charge for scrap or repairs can be deducted only from any amount earned in excess of the rate per hour times the number of hours worked.

four surplus hours on department labor, a deduction of four points from the allowance of five would be made, leaving a balance of one.

The money value of the scrap (labor and material) and repairs is listed on the form, together with "donations," if any are paid. "Donations" is a term applied to any payment made to a workman in excess of his actual earnings from production. For example, let us suppose that John Jones, who has a rating of $ .50 per hour, works 48 hours but turns out only the equivalent of 24 hours' production. His pay is $ .50 x 48=$24, but his real earnings are only $ .50 x 24=$12. Therefore $12 is actually "donated" in order to give him his guaranteed minimum of pay—$24 per week.

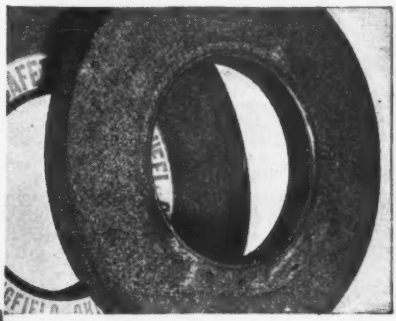
(Continued on page 38)

Rooted to the Spot!

Inner surface of "Perfec-Hole" lining is embedded in pores of wheel

Forcibly tearing the "Perfec-Hole" lining from the wheel. Note texture of the inner surface showing how the metal was squeezed into the pores.

The patented SAFETY "Perfec-Hole" Wheel goes on easily, without forcing and with no scoring of the adapter. An accurate slip-fit is guaranteed.



The "Perfec-Hole" lining consists of sheet lead 1/32" thick, which is affixed under pressure by an ingenious process. Note in the photograph how tightly it adheres to the wheel.

This lining is formed with extreme precision, which guarantees a PERFECT FIT on the adapter and a wheel EXACTLY SQUARE with the spindle. No forcing, trimming, or shimming is needed to put the wheel on. And there's no wobble when it runs.

Since the lining has negligible weight and is laid on evenly, it does not affect the original dynamic balance of the wheel nor disturb this balance during the course of wear, as would be liable with a molded or poured bushing of such diameter.

You will readily appreciate, therefore, that SAFETY "Perfec-Hole" Wheels afford all the recognized economies and advantages of large-hole wheels with none of the customary difficulties. More than that, "Perfec-Hole" Wheels are sold at standard prices. The EXTRA VALUE is given without ADDITIONAL CHARGE. Shall we send you further information?

The SAFETY GRINDING WHEEL & MACHINE COMPANY

2318 Columbus Ave. Springfield, Ohio

"A wheel for every need" . . . backed by 37 years' experience.

Thor Electric Drills

Built like a Battleship

FROM spindle end to grip handle a Thor is built of rugged, easy running parts. It has power—more than you'll ever use, but it's there for emergency. It's speedy—a super-power motor takes care of that.

A Thor will stand hard, severe use, because it is built to withstand it. It will bite its way quickly through iron, steel or wood and makes short work of difficult jobs.

Thor dependability is an important thing to you, and a feature which we cannot stress too much. To know, absolutely, that a Thor will respond when you press the switch, is a valuable advantage that will appeal to you.

For fast drilling—for light drilling—for heavy drilling—or any kind of drilling—the Thor will outperform any drill of the same capacity.

Thor Electric Drills are built in a complete line of sizes and types. Included are screw drivers, nut setters, tappers, grinders and reamers. Write for catalog No. 17.

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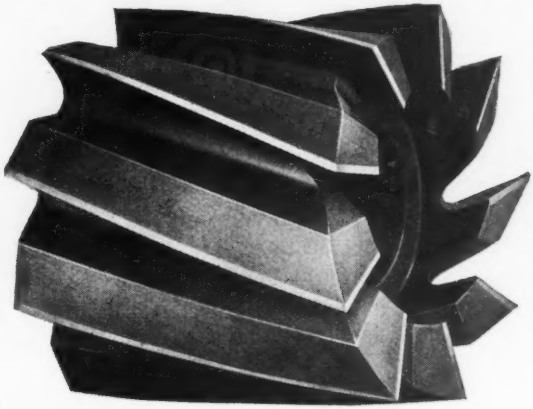

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Saws

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Standard Cutters in Stock
Special Cutters Made to Order

BARBER-COLMAN COMPANY

General Offices and Plant — Rockford, Ill., U. S. A.

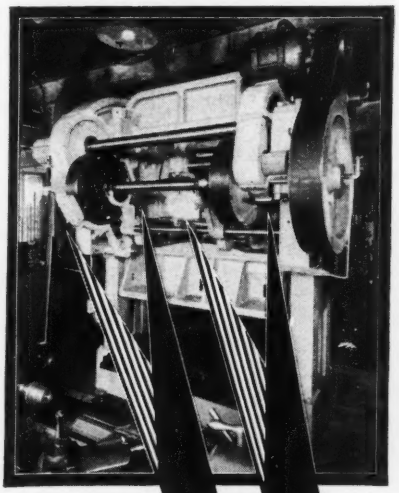
The Machine Is No Better Than Its Chuck

By JOHN MARCHMONT

THE metal working industry is in a constant state of development. Each day sees yesterday's standards of strength and accuracy cast aside for new standards, and each day witnesses new achievements in the design of machinery which will produce more, be more accurate, and require less individual skill than has been possible before. The development of cutting alloys which will stand up under heavier cuts, at higher speeds, has placed an obligation upon the machinery manufacturers to create units with which these speeds and these cuts can be taken. The executives in production plants have learned that loose limits or lack of accuracy in the machine shop is paid for many times over in the assembly room, and, inversely, extreme accuracy in the machining of parts means smooth, rapid work in the assembly department. Accordingly, every effort is being bent in the direction of developing faster and more accurate production machines.

Machine shop work includes a great many operations in which chucks are used—drilling, reaming, tapping, profiling, and so on. It is consistent that these operations should be performed at the same high rates of speed which prevail on other operations, but in too many cases the manufacturer loses sight of the fact that the machine is no better than its chuck. A sturdy, strong and accurate machine, with all the latest improvements in drives and change gears, and with heat treated,

Fig. 2—Chuck of modern type, with hardened and ground parts, ensuring accuracy and maximum gripping power.



Williams, White & Co. No. 6-72 Double Crank Tie Rod Press. 72 in. between housings, with 6-in. stroke. Capacity, 130 tons.

WHEN A *REVERSING* TIE ROD PRESS WAS WANTED...

A Detroit tool and die company needed a tie rod press for testing the stamping and forming dies they build for the automotive industry. They wanted the advantage of a ***reversing drive.*** Williams, White & Co., Moline, Illinois, gave it to them...by equipping the press with Twin Disc Clutches: 18-inch, cone action type, with non-friction surfaces.

The same hand lever operates both clutches, one for forward motion, the other for reverse motion. The brake, which was added, is in engagement with the clutch lever in neutral position to prevent the ram coasting.

Designers of modern machine tools consider Twin Disc as clutch headquarters, for clutches that are as adaptable as they are dependable. The variety and number of stock model clutches, and the advantageous combination of volume production and precision workmanship, make the use of Twin Disc Clutches economical as well as practical.

For special jobs, there is placed at your disposal the invaluable experience of our Engineering Research Department...equipped to co-operate with you ***all the way.*** Write for Engineering Data Book or specific recommendations. ***Twin Disc Clutch Company, Racine, Wis.***

TWIN DISC CLUTCHES

hardened and ground spindles and other parts is a beautiful piece of work, but all of the skill and effort that have gone into the construction of such a machine are practically lost when the machine is equipped with a badly-worn chuck.

A survey of the chucking equipment in use throughout a large part of the country has brought to light the fact that there are thousands of chucks still in use which had outgrown their usefulness when high speed still was in its infancy. Savings are being made possible by the use of faster machines and better tools, only to be wasted again through the use of chucks which waste the operator's time, damage the tools, and produce work which, in many cases, is so inferior as to require repairing before it can be used.

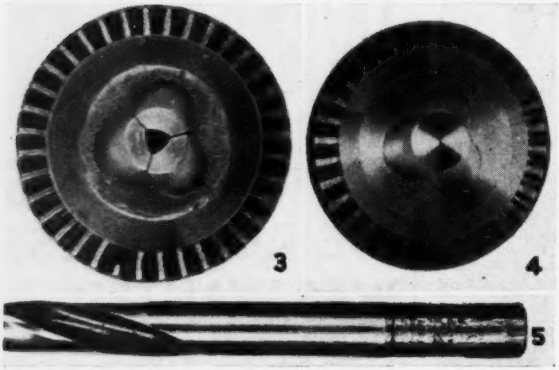


Fig. 3—Jaws of worn-out chuck. Fig. 4—Note the accurate fit of these jaws. This chuck would grip a hair. Fig. 5—Here is a drill that has been badly "chewed" by using it in a worn-out chuck. No good mechanic wants to use a tool in this condition.

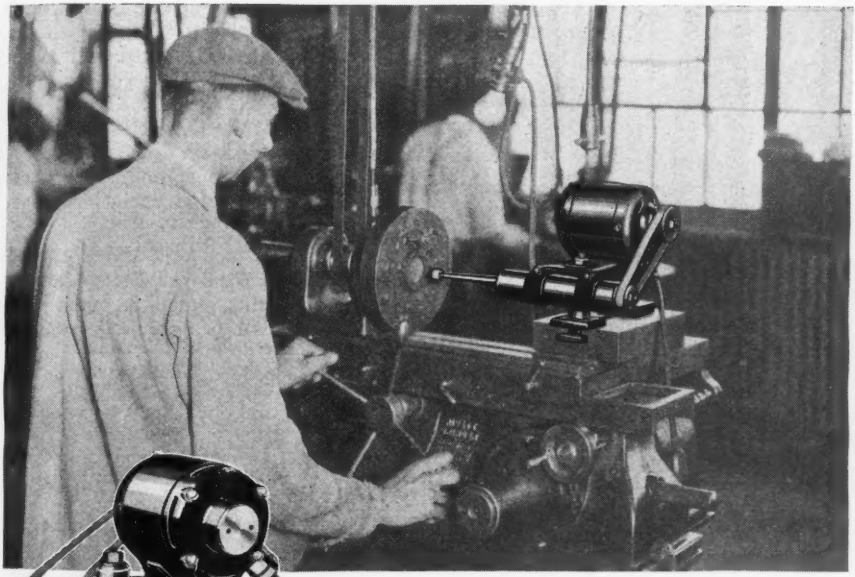
Among the chucks which were discovered during this survey is the chuck shown in Figure 1. Inquiry brought out the information that this chuck was made at the time Henry Ford was turning out his first automobile, and is still in use in 1930—after he has built his fifteen millionth car. This chuck is a fair sample of thousands of similar chucks that can easily be discovered by anyone who will take the trouble to look about. The body of the chuck is soft, the jaws are worn to such a point that the gripping power is nearly gone, and nothing like accurate work can be obtained—or even expected—from this tool. Compare this chuck with the chuck shown in Figure 2. Here is a chuck built upon a hardened steel body, insuring a tool that cannot be battered out of shape and in which any wear of the pinion hole is prevented, thereby insuring perfect mesh of the geared teeth at all times.

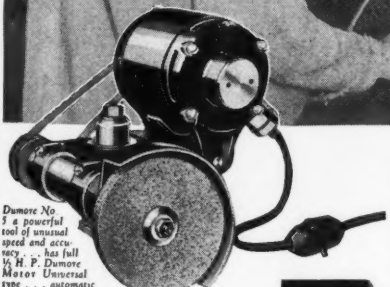
Upon holding the old chuck up and looking at the jaws, as we see them in Figure 3, the hard service to which this chuck has been subjected is readily apparent. Compare these jaws with the jaws of the new type chuck as shown in Figure 4. These jaws are so accurately fitted that it would be almost possible to grip a hair between them. The jaws of this chuck are made of a grade of steel which has been selected especially for this purpose and which combines strength with hardness. With such a chuck, a grip can be obtained which would have been impossible with the old chuck even in its best days.

A badly-worn chuck is not only a potential source of loss through the inability of the chuck to hold the tool and the inaccuracy which necessarily results from the use of such a chuck, but it is also a source of loss through the mutilation of the tools that are held in it. Not only will the chuck

CONTINUOUS PRODUCTION WITH PRECISION

. . . . by a Dumore No. 5 at the Davenport Machine Tool Company





Dumore No. 5 a powerful tool of unusual speed and accuracy . . . has full ¼ H. P. Dumore Motor Universal type . . . automatic oiling system . . . fan keeps the motor "cool" at all speeds . . . aluminum housing for light weight . . . variable speed . . four quills . . . 4 pulleys . . . automatic belt tension . . . precision to .0001" . . . spindle speeds of 3,600 to 31,000 R. P. M.

ABOUT a year ago, the Davenport Machine Tool Company, Inc., Rochester, N. Y., experienced difficulty with a large internal grinder. It was driven by overhead shafts and long belts, was undependable for constant precision work, and required repairs about every 3 weeks.

A No. 5 Dumore Grinder was then purchased, due largely to the splendid performance of a No. 3 Dumore in their general shop work. The No. 5 was put into production on a ½ inch thick cam blank, grinding out a 2 inch hole. Approximately .0005 of an inch is ground out at each cut. Tolerances run from standard dimensions to plus .0001 of an inch.

Today the Davenport Machine Tool Company says: "We have never regretted our choice. The real value of the Dumore lies in its continued operation and in the class of work turned out . . . a uniform quality of grinding at all times."

THE DUMORE COMPANY
28 SIXTEENTH STREET RACINE, WISCONSIN

THE DUMORE COMPANY
28 Sixteenth St., Racine, Wis.

Please send details of the New No. 5 Dumore together with a free copy of "Precision Grinding"

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DUMORE HIGH-SPEED GRINDERS

REG U. S PAT OFFICE

fail to hold the tool firmly, necessitating a lighter cut and frequent tightening of the jaws, but it will also

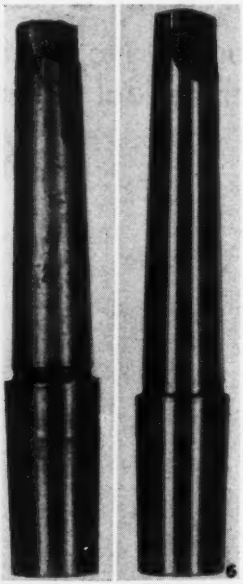

Fig. 6 (Left)—Arbor of chuck shown in Fig. 1. An accurate job with such a tool is practically impossible. (Right)—Arbor of new chuck.

"chew" the shank of the tool as shown in Figure 5. Once a tool is damaged in this manner, it is practically impossible to perform an accurate operation with it henceforth. Knowing such to be the case, the mechanics will avoid using the drill and, if it is still a good tool otherwise, the tool represents a complete loss.

At the left in Figure 6 is shown the arbor or shank of the chuck which is shown in Figure 1. The tang is broken, the arbor is full of nicks—any one of which alone would probably ruin the accuracy of an otherwise good tool—and the lower part of the arbor is badly battered where it has been hammered by a zealous but unintelligent workman. Accuracy with a chuck-arbor in the condition this one is in is absolutely out of the question. An error of .001 in. in the fit of this arbor at the tang end would undoubtedly produce an error of at least .010 in. at the point of the drill. Undoubtedly, were this same workman attempting to perform an accurate drilling operation, he would hit the drill at the point with a hammer in an effort to bend it and make it run true and thus, in reality, ruin the accuracy of the drill. At the right in this same illustration is shown an arbor of a modern drill chuck. A new drill, in a chuck mounted on this arbor, would show no variation whatever at the point.

A modern chuck of the key type is illustrated in Figure 7. Every individual part in this chuck is made of a material which is especially selected

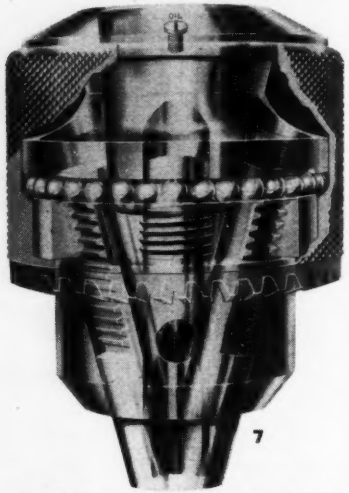

Fig. 7—Modern chuck of the key type. Strength, accuracy, and ease of operation are combined to make this tool an example of modern engineering skill.

and processed to produce the results required and to perform the task required of it. The ball bearings reduce

You Cannot See the Wood for the Trees

IT is so in almost every industrial plant. All of us are prone to overlook familiar objects — things that we look at day after day and do not see. It is quite possible, for instance, to walk through a plant and not notice an old chuck which has had constant use and some abuse — an old chuck on which the jaws are worn — jaws which bell-mouth or heel — jaws which do not properly hold work or cutting tool. Then, too, it is common practice to find a chuck holding work or tools which are larger than the size of the chuck warrants. Also chucks are frequently applied to operations for which they were not designed.

Such shop conditions make for inaccuracies. It is costly manufacturing because it reduces the production capacity of the machine, takes up the operator's time, and labor cost is far greater than chuck cost.

This practice of using antiquated and inadequate chucking equipment should be corrected by replacing old chucks with new improved models, particularly adapted to the work at hand.

Your dealer has a man who knows about the mechanical advancement in chuck design and he has the resources of the chuck industry behind him.

The CHUCK MANUFACTURERS of AMERICA

the friction required to operate the jaws so that they can be spun open and shut by hand, yet the greater speed of operation is accompanied by a far greater gripping power and strength than have been possible with chucks of the older type. The balls are accurate within .0001 in., which insures that each ball will carry its share of the load. The jaws are just as accurate, and are carefully heat-

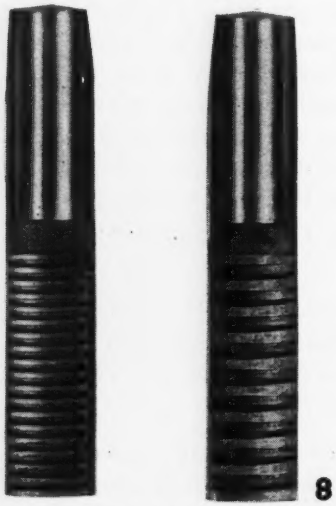

Fig. 8 (Left)—Jaw of plain bearing chuck. (Right) — Jaw of ball-bearing chuck. Note heavier pitch of thread, combining speed of travel with strength.

treated, hardened and ground to size. The moving parts are encased in a body which is deeply case hardened throughout, and the arbor hole is ground for a perfect fit to the arbor. Compare one of the jaws of a chuck of this type, as shown at the right in Figure 8, with the jaw of a chuck of the plain bearing type, as shown at the left in this same illustration. Note the coarser pitch of the thread, which not only means that twice the speed of travel is obtained, but also that a 10-ton load can be put on the end of one of these jaws before the thread will fail.

In Figure 9 is shown an X-ray view of a modern keyless, self-tightening chuck. The chuck is tightened by hand, no key being necessary, and is rapid in operation. This chuck is also of the ball bearing type and is both easy to operate and accurate. The threads in the mechanism of the chuck are generated, and are accurate within a fraction of a thousandth of an inch. The use of such a chuck with the finest drill press that engineering skill can produce would be entirely consistent.

The best results will be obtained if attention is given to selecting the right sized chuck for the job. The sensitiveness required for the accurate drilling of a very small hole is hard to obtain when a heavy chuck is used, even though that chuck is perfectly accurate. On the other hand, the chuck should be of a size which will afford the necessary strength to hold the tool. Under no circumstances should a chuck be struck with a hammer of any kind. More damage can be done to a drill chuck with one blow of a lead maul than would occur in years of ordinary careful use.

Another frequent cause of damage to drill chucks is that resulting from carelessness in allowing the chuck to fall when it is being removed from the machine spindle. When a chuck is allowed to drop either on the floor or bench, striking upon the point of the jaws, no damage may be apparent, yet, at the same time, the accuracy may be impaired just enough to render the tool useless for fine, accurate work. Chucks that are not in use should never be allowed to lie around in the dirt and chips on the floor; instead, an effort should be made to accord them the same care that would be given to any other fine mechanism.

(Continued on page 38)

Performance....

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USERS of the Cincinnati "HYPRO" Openside planers know that these machines may be depended upon to do the rough work as well as the accurate work . . . and do both at a *profit.*

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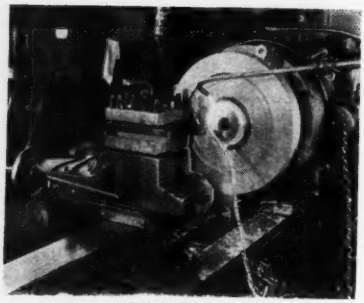

Courtesy of Philadelphia Gear Works, Philadelphia, Pa.

OPERATION: TURNING 16 INCH O. D. GEAR BLANKS.
MACHINE: 26 INCH LIBBY LATHE.
MATERIAL: 1040 CARBON STEEL.
WIDTH OF CUT: ¾ IN.
FEED: ⅛ IN.
SPEED: 13 R. P. M.
LUBRICANT: 1 PART SUNOCO TO 10 PARTS WATER.

THROUGH the entire range of the metal cutting industry, Sunoco is regarded with favor. Long experience has taught this industry that no matter how well built the machines, how powerful, or how tooled, production fails if the cutting lubricant cannot do its part. In large numbers, manufacturers turn to Sunoco to fill the important need for a dependable cutting oil—and Sunoco's performance justifies their faith.

Deeper and faster cuts are possible, production increased, work is kept cooler, tool life lengthened, materials protected from rust and corrosion, systems require cleaning out and replenishing only about half as often, and its net cost is less.

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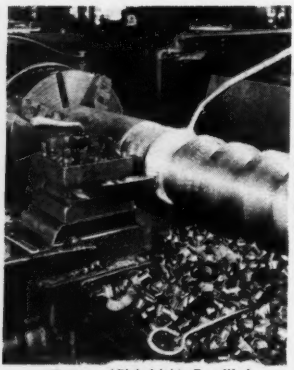

Courtesy of Philadelphia Gear Works, Philadelphia, Pa.

OPERATION: TURNING 7½ INCH O. D. GEAR BLANK.
MACHINE: 18 INCH LIBBY LATHE.
MATERIAL: STEEL FORGING.
CUT: ⅞ IN.
FEED: ⅛ IN.
SPEED: 60 R. P. M.
LUBRICANT: 1 PART SUNOCO TO 10 PARTS WATER.

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SUNOCO is perfect in its emulsion. It will not separate, nor will it turn rancid. Cuts on workmen's hands will never become infected.

It is possible that there is another cutting lubricant which will equal Sunoco in performing *one* of the important functions of a cutting agency, but we are quite sure there is none which will even approximate its performance on *all*.

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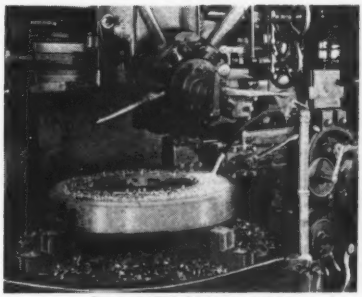
The Sun Oil Company produces a type of cutting oil to meet every metal-cutting requirement

SUNOIL COMPANY, Ltd., Montreal, Canada.

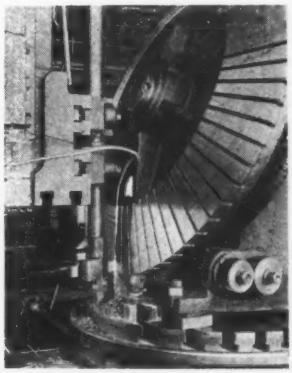
OCO
CUTTING OIL
of BLUE SUNOCO MOTOR FUEL



Courtesy of Philadelphia Gear Works, Philadelphia, Pa.

OPERATION: TURNING AND FACING 29 INCH BEVEL GEAR BLANK.
MACHINE: 42 INCH BULLARD VERTICAL TURRET LATHE.
MATERIAL: DUPLEX GEAR STEEL NO. 1.
CUT: 3/8 IN. FACING, 7/8 IN. TURNING, O. D.
FEED: 1/8 IN.
SPEED: 42 F. P. M.
LUBRICANT: 1 PART SUNOCO TO 10 PARTS WATER

OPERATION: SLOTTING BEVEL GEAR, 10 INCH FACE.
MACHINE: BEMENT-NILES SLOTTER
MATERIAL: STEEL CASTING.
DEPTH: 1/4 IN.
STROKES: 10 PER MINUTE
LUBRICANT: 1 PART SUNOCO TO 10 PARTS WATER.



Courtesy of Philadelphia Gear Works, Philadelphia, Pa.

Montreal, Newark, New York, Ottawa, Philadelphia, Pittsburgh, Providence, Quebec, Quincy, Reading, Rochester, Scranton, Syracuse, Tampa, Toledo, Toronto, Trenton, Tulsa, Wilmington.

Machine No Better Than Chuck

(Continued from page 34)

Finally, it should be remembered that the bearing surfaces in a chuck have the same relation to each other that the bearing surfaces have in any other piece of machinery, and a little oil should be applied to the working parts (without, however, taking the chuck apart) at frequent intervals. When inserting the arbor of a chuck into the spindle of a machine, care

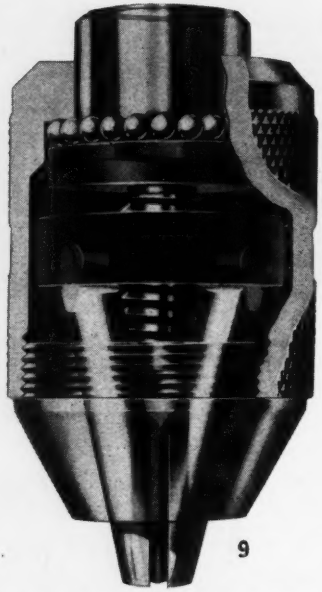


Fig. 9—X-ray view of modern keyless, self-tightening chuck.

should be taken to make sure that the arbor and spindle socket are clean and free from dirt.

Good chucks are much more important than the consideration given them in the past would indicate. Regardless of the type of machine employed, no job is operating at its highest point of efficiency unless the chuck is as modern and as well cared for as the machine. It is safe to say that any plant executive who will look over his chucking equipment will find, somewhere in the plant, at least one job on which enough time is being lost each day, through the use of a worn-out chuck, to pay for a new chuck. "The machine is no better than its chuck."

Base For Rating Foremen

(Continued from page 24)

While this system seems complicated, it really requires but a few hours each week to keep it in operation. A "Foreman's Efficiency Report," listing and totalling the items and ratings, is made out for each department. All the reports are then given to the superintendent, who distributes them personally to the foremen, usually with comments of either praise or criticism. This method of measuring a foreman's ability has many advantages over the old method of judging a foreman according to the amount of production he turned out, regardless of the cost of producing it. There is no question but that the efficiency of many shops—even those operating on a day-work basis—could be raised considerably if properly-determined standards were set up to govern the costs of operation.

When you want to see where a file is cutting, change the direction of the stroke.

Don't put pressure on the back stroke when filing.

Apply pressure enough so that the teeth will cut instead of merely sliding over the work, otherwise the teeth may be ruined.

Have a rack for your files and treat them as you would any other edge tools; that is file economy.

Keep your files dry and free from rust.

Rubbing chalk into the teeth helps when making fine, smooth cuts.

Simonds Saw & Steel Co.

This book was prepared for you with the cooperation of fourteen of the most prominent manufacturers in their respective fields, who permitted a nationally known firm of engineers to enter their plants and make studies of fastening methods which have proved particularly advantageous.

Every plant executive who is interested in the production of a product made wholly or partly of metal will find "Fastenings" interesting and helpful. Distribution of the book must be limited to those concerned with production, who may obtain it free.

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Inducing Workmen To Wear Goggles Not a New Problem

By RUSSELL J. WALDO

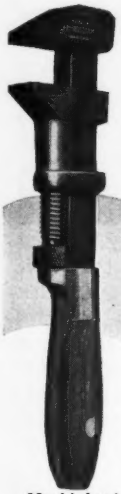
THE problem of inducing workers to wear goggles while performing hazardous work has long been perplexing safety engineers and other industrial executives whose positions place upon them a measure of responsibility for the safety of the workmen. Industrial workers—like the rest of the world—are prone to take a chance on being injured rather than take precautions to which they are not accustomed, and all sorts of excuses have been offered by workmen who wished to avoid the wearing of goggles while working. This is especially true of workers who were required to wear goggles only when grinding tools.

While serving as an employment interviewer at an ammunition plant during the late war, the writer ran into some unusual experiences with girls who worked overtime to avoid wearing goggles at their work. The objection most commonly given was that the goggles made the wearers' faces too hot and caused too much perspiration. This objection was overcome when goggles were supplied equipped with mesh guards which allowed a free circulation of air between the lenses and the face. Others raised the objection that the bows with which the goggles were equipped hurt the ears of the wearers. This objection was eliminated by replacing the bows with elastic straps which could be passed around the head and hooked together at the back.

One of the best grinding machine operators in the plant was a girl who wore glasses. After making an attempt to wear the goggles over the glasses, she complained that the goggles impaired the clearness of vision which the glasses were supposed to provide, making it impossible for her to see her work clearly. This condition was more serious than going without goggles, insofar as production was concerned. The condition was remedied by sending the girl to an oculist who ground a special pair of lenses to fit the frames of her goggles, thus making the goggles serve both purposes. The girl paid half the original cost and the company furnished extra lenses to replace any which might be broken.

The objection to wearing both glasses and goggles could be overcome in no other way at that time, but the

Two Factors



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7 sizes
6 to 21-in.

PRACTICAL DESIGN and the reputation of the manufacturer are the two most important factors to consider when purchasing tools. A great many tools are discarded or broken each year because these two factors were overlooked in the first place.

Take Williams' "W&B" Screw Wrenches. They're not a "one-year" tool. They've been on the market for a generation. Quality is the answer. A "W&B" will stand the hardest use and still be on the job for MANY years. Be sure your next wrench is a "W&B."

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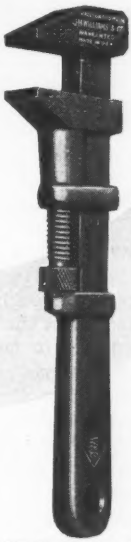

"Railroad Special" with Indestructible Iron Handle
7 sizes
6 to 21-in.

writer has since seen goggle lenses which can be slipped into place over the lenses of ordinary glasses and attached instantly. The goggle lenses are made of tough "safety" glass which protects both the eyes and the glasses of those who must wear glasses at their work.

In this plant, like many other large plants, a safety bulletin board was located adjacent to the time clocks. Posters intended to stimulate interest in safety were tacked on this board at regular intervals. Equally effective was a notice which read "The ——— Company supplies goggles for every workman in a hazardous occupation. These goggles are furnished at no cost to the worker. We insist that they be worn at all times on dangerous or hazardous work." The first time a workman was found working on grinding, chipping, or similar hazardous operations without goggles he was spoken to quietly, without intention to embarrass him. The second time, his name was posted on the bulletin board as a second offender, and the third infraction of the rule was cause for transferring him to another job.

Every effort was made to co-operate with the workmen in the matter of goggle-wearing. All goggles were issued from the hospital and each pair was fitted to the wearer. The workman was required to read through them before they were issued to him, to make sure that his vision was not impaired in any way, and he was given final instructions that he should return to the hospital if the goggles needed adjustment of any kind. In every instance a case was supplied with the goggles and the workman was instructed that the goggles were to be kept in the case and the case in his pocket when the goggles were not in use. This point was insisted upon after it was found that, in many cases, the workman would go to the grinding wheel to grind a tool and forget to take his goggles with him, then he would grind the tool without the goggles rather than go back after them. Cases are cheap compared to the savings in time, money and manpower for which they are responsible.

Discomfort caused by goggles can in most cases be eliminated by proper adjustment. The writer has yet to find a consignment of two dozen goggles in which the goggles were identical in shape, size, and the grinding of the lenses. In the last few years a number of employers have found it expedient to have the goggles fitted to the wearers by an optician who at the same time tests their vision. In many cases corrective lenses are provided, thus giving the worker better vision and making it a double object for him to wear the goggles. Goggles should be inspected at regular intervals to make sure that they are in good condition. Workmen are likely to wear their goggles too long after they have become pitted from flying particles. This danger should be guarded against to avoid impairing the vision of the workers permanently. The modern types of goggles are so constructed that new lenses can be inserted into the frames in a few seconds, avoiding loss of time.

"U. S." Flexible Shaft Equipment Catalog

The United States Electric Tool Co., 2471 West Sixth Street, Cincinnati, Ohio, has issued a catalog describing and illustrating the flexible shaft equipment made by this firm. The catalog describes flexible shaft machines from ¼ h.p. to 3 h.p., in all styles of mountings—overhead, vertical, trolley, floor, stand, bench or horizontal. The book includes descriptions and illustrations of a complete range of tools for engraving, filing, rasping, polishing, grinding, and so on.

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FORMICA

Short-Cut Fire Preventatives

By PAUL A. BARD

MACHINE shops are, as a rule, considered very good risks by fire insurance companies, due to an absence of highly-combustible and inflammable materials and processes. Notwithstanding, many costly fires occur each year in machine shops and metal-working plants of other classifications. A machine shop was damaged to the extent of $45,000 recently when a blaze started in a pile of steel shavings just outside the plant walls. Some careless workman had thrown a lighted cigarette stub into the pile, igniting the oil in the shavings and starting a fire which destroyed part of the plant. Many machine shop fires have been caused by spontaneous combustion in oil-soaked rags or waste that have been allowed to accumulate in out-of-the-way places, and some very disastrous fires have followed careless handling of fire in the vicinity of the nitro-cellulose lacquers which are now in almost universal use for finishing both wood and metal products.

In addition to the usual methods of extinguishing fires by the use of fire hose, chemical extinguishers, and so on, there are at least two ways in which this equipment may be supplemented to good advantage. The materials involved cost practically nothing and may prove very valuable, should a fire start. Also, both of the methods advocated are intended primarily for use with blazing oil, which seems to be the chief cause of fires in metal-working plants.

The materials necessary are a quantity of carbon tetrachloride and a number of burnt-out 250-watt and 500-watt lamp bulbs, which usually accumulate around a plant of any size. Carbon tetrachloride is used extensively in certain types of fire extinguishers for putting out fires in oil, on automobiles, or on electrical apparatus. By cutting the ferrules off the lamp bulbs and filling them with the carbon tetrachloride, fire extinguishers can be manufactured at comparatively small cost.

After the lamp bulbs have been filled, they should be sealed tightly and placed at strategic points about the plant. If a fire starts in any part of the electrical circuit or in oily materials, one of these lamps should be thrown at the fire as one would throw a bomb or hand grenade, breaking the lamp and scattering the extinguishing material over the blaze. One will usually be sufficient to extinguish a small fire. The carbon tetrachloride works by evaporation, taking up space otherwise occupied by air and thus snuffing out the fire by cutting off the supply of oxygen. It is particularly effective in the case of electrical fires and other fires that are just getting started. As carbon tetrachloride is a non-conductor, it will not injure electrical equipment or insulation, nor is it injurious to workmen.

Another simple method of putting out oil fires (and this suggestion applies to oil fires only) is to blanket or snuff out the fire by covering it with a non-combustible substance which will cut off the air supply and, to a lesser extent, generate gas of a non-combustible nature. There are several types of chemical fire extinguishers on the market for this purpose, and every plant should be equipped

(*Continued on page* 102)

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Hercules Punches lend themselves *profitably* to practically all punching operations—setting new standards of performance. Their precision, superior steel and controlled heat treatment result in a punch vastly superior to the usual product.

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HERCULES INTERCHANGEABLE PUNCHES AND RETAINERS

Modern Tooling Practice, VII

By FRANK W. CURTIS

BORING and reaming tools, while to some extent obtainable commercially as standard products, sometimes have to be designed for a particular class of workpiece. There are many types and styles from which to select boring bars or reamer heads, in the design of which certain basic features are incorporated. The average boring or reaming operation is not difficult, as a rule, yet there are hindering factors in some classes of work which may cause considerable difficulty. For example, the production of a true, smooth bore in a rough casting is not always a simple matter.

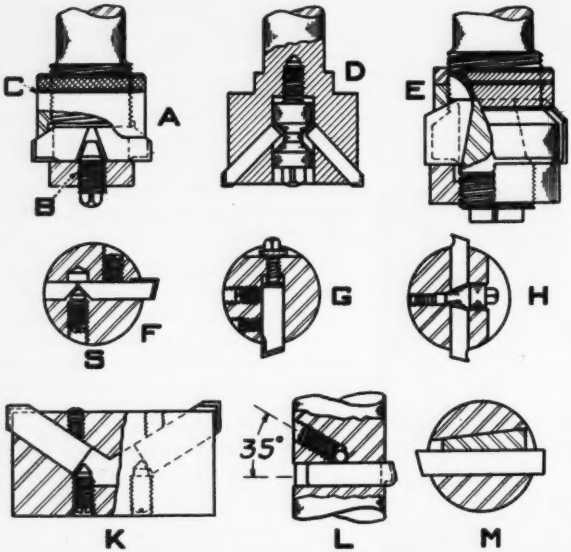
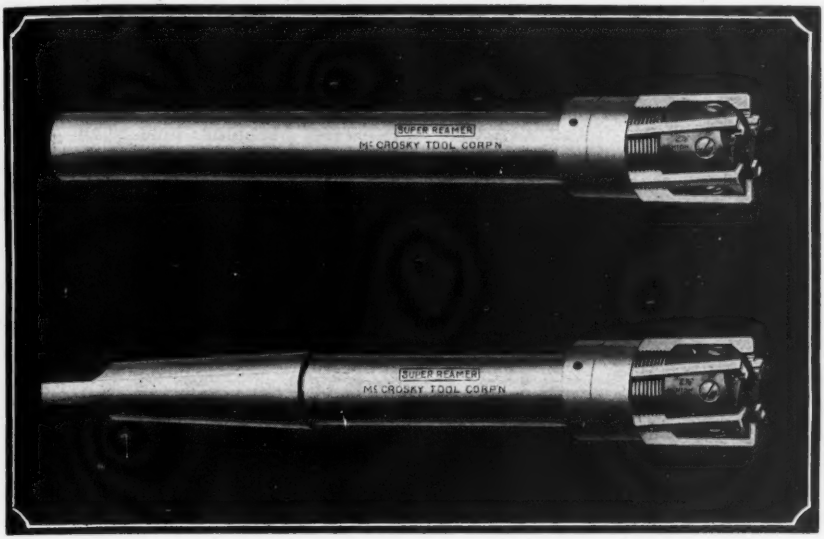


Fig. 52—Methods of locking tools in boring bars.

In some classes of work variations in the hardness of the metal to be bored are likely to cause unevenness, therefore it is sometimes necessary to provide both roughing and finishing operations. When a hole is bored from the rough, the variation in the depth of cut is also likely to cause an out-of-true hole. An absolutely rigid bar is of considerable advantage in the production of a true bore, but the rates of feed and speed are, of course, to be considered carefully. When a boring tool strikes a hard spot in a casting, or an excessive amount of stock, the added stress will usually cause a slight deflection of the tool.

In using boring tools tipped with cemented tungsten carbide, which will ordinarily run at a comparatively high rate of speed, the tool may be deflected due to the generation of excessive heat. In heavy work this condition is not so noticeable, but in boring material having a thin wall the condition will be quite pronounced and provisions should be made to eliminate the difficulty either by reducing the feed or by the use of an adequate supply of coolant. When work is bored from the rough there is also the possibility of distortion, due to the release of internal strains, particularly when machining cast iron. When the scale is removed, any strains that may have been set up during the casting process are relieved. However, heavy walls will not



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give as much trouble as walls that are comparatively thin.

In boring a cylinder casting, the distortion is apt to be quite noticeable on account of the variations in wall thickness. Portions of the wall that are braced by ribs and webs will be rigid, whereas other sections, being weaker, will spring under cutting pressure and allow deflections. For this reason it is well to make boring bars as rigid as possible and to provide tools of a suitable nature.

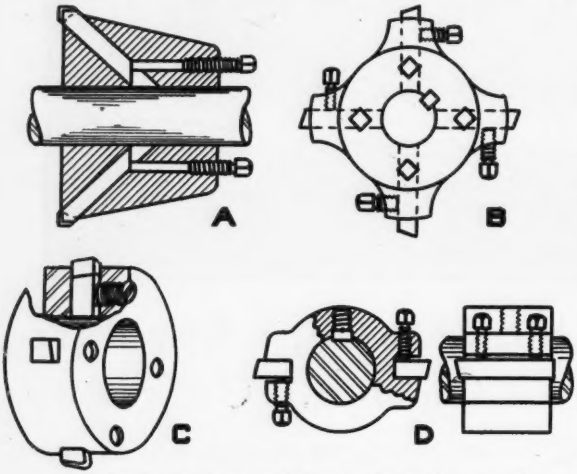

Fig. 53—Designs of boring heads for large work.

There is some difference of opinion as to whether a single point boring tool, which generates a hole, should be set above, below, or exactly on center. From general results, it appears that the tool should be set slightly above center, but not enough so that any deflection of the tool will cause the cutting edge to dig into the work. To be on the safe side, it is well to set the tool anywhere from 1/64th to 1/32nd inch above center, depending, of course, upon the diameter of the bore.

When using a boring bar that has a number of blades or cutting tools, there is always a question as to how many cutting edges should be used. There is no set rule, because the nature of the workpiece, depth of cut, type of machine, and the speed and feed are factors to be considered. Some tool designers hold to the opinion that a boring job can best be performed with a tool that has several cutting edges—say four or six—when followed by a two-bladed reamer, whereas other engineers, designing tools for the same class of work, turn these proportions around and provide a tool with two cutting edges for boring and possibly a six-bladed reamer for finishing.

Rather good results have been obtained by using a single-point boring tool for small holes up to approximately two inches, a double-point boring tool for holes up to approximately four inches, and boring heads with four, six, or eight blades for the larger sizes. Reaming can be done with either two, four, or six blades.

Variety of Boring Bars

In Fig. 52, at **A**, is shown a double-blade boring bar in which provision is made for adjustments. The inside end of each blade is made with an angular surface against which the cone-shaped screw **B** strikes. To adjust the tools, the clamping pressure is released and the screw is adjusted to suit. If required, the adjusting angle and the threads of the screw can be calculated so that graduations can be placed on the screw, thus providing a micrometer adjustment. The blades are locked by means of the adjustable collar **C**, mounted on the threaded

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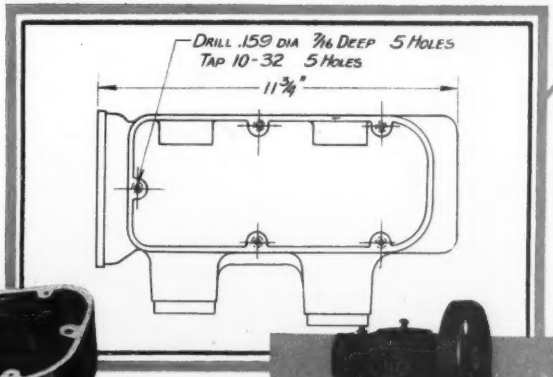

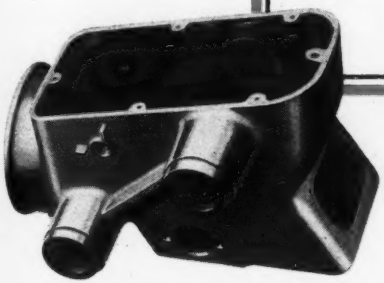

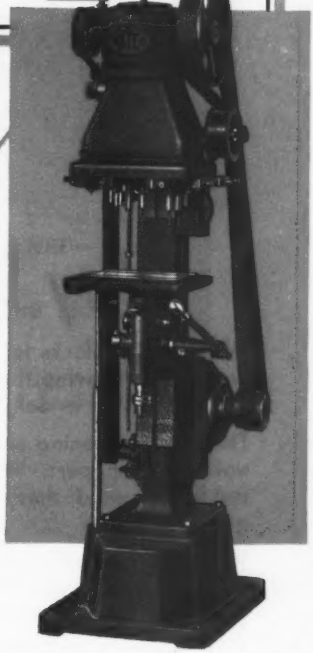

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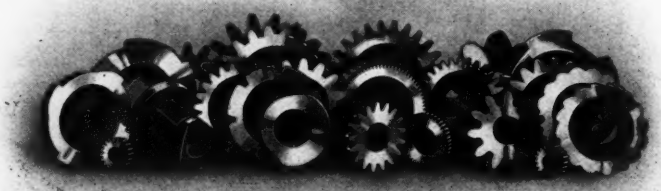

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Modern Tooling Practice

(*Continued from page 48*)

portion of the bar. The collar is made with an angular contacting face which strikes the upper edges of the blades, holding them securely. A lock nut is provided to prevent the collar from becoming loose.

Another form of adjustable boring head is illustrated at **D**. In this case the adjusting screw is also made with an angular contacting face that strikes the back end of the tools. This design will be found especially useful for boring holes from 3 to 5 inches in diameter, although with slight modifications it can be adapted for other sizes. At **E** is shown another form of adjustable boring head in which the blades fit into angular grooves machined in the body of the bar. Clamping of the blades is accomplished by the use of a collar and lock nut. Either of the three designs shown can be arranged for reaming purposes as well as for boring.

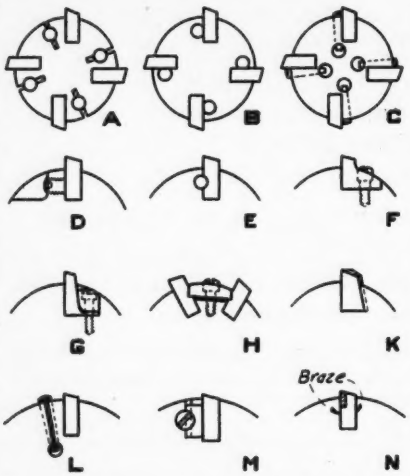

Fig. 54—Designs of reamer heads, showing methods of holding blades.

At **E** is shown an adjustable-type boring tool, using a conventional form of tool bit. Adjustment for diameter is attained by the pointed setscrew which strikes the angular-faced heel of the bit. Another adjustable boring bar is shown at **G**, the adjustment in this case being obtained by the use of a graduated screw, with which micrometer adjustments can be made. At **H** is shown another method of adjusting a boring tool for a bar carrying two tools. The bar at **K** has two cutting tools with individual adjustment, provided by pointed setscrews. The advantage of this type of bar is that if one tool should become dull, by striking a hard spot or otherwise, it would not be necessary to regrind both tools. The illustration **L** shows a unique method of locking a tool in a bar. This method is used rather extensively and is quite positive. If required, a backing-up or adjusting screw can be included. The lock is made by drilling a hole at an angle of 35 degrees, so that the hole just breaks through the tool-slot opening, then tapping the hole and placing a steel ball in it. A setscrew is then inserted as shown. If the hole is drilled to the proper depth, the ball will not fall through the tool-slot opening. The advantage of this method of locking is that the ball will not come out when the tool is removed. At **M** is shown a wedge-type lock for holding a boring tool in a bar. The tool slot is in this case made flat on the bottom surface and angular at the top, so that the wedge can be driven in to form a solid lock.

In Fig. 53 are shown various designs of boring heads for large work. One of the first considerations in designing a boring head is that the bar must be of sufficient size to avoid vibration. When the diameter of the hole to be bored exceeds twice the diameter of the bar, it is practically impossible to avoid vibration and chatter, which is more pronounced as these proportions are increased. For example, if the bar is two inches in diameter and the cutter head is five

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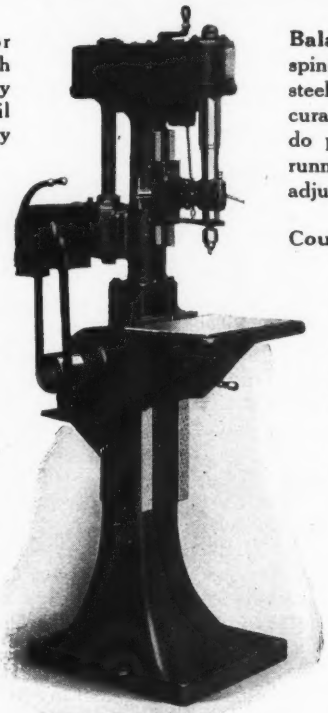

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inches in diameter, the construction must be very rigid or vibration is likely to develop. The design **A** shows a head provided with adjustable features, so that the various blades can be adjusted independently of one another. The type of head shown at **B** is often used for large work, and is arranged so that the tools are set vertical in relation to the axis of the bore. At **C** is shown another form of boring head, which to some extent is similar in design although instead of being a casting it is machined from a section of bar steel. The type of boring head illustrated at **D** is used frequently for boring holes which exceed three inches in diameter. The body is made of cast iron and is provided with two slots placed opposite each other as shown.

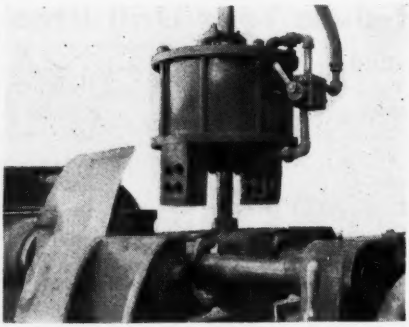

Fig. 55—Air-operated clamp for holding locomotive brasses.

A variety of methods for holding blades and reamer heads is illustrated in Fig. 54. The design shown at **A** employs tapered pins which are driven into holes intersected by a slot. As the pin is driven in, the slot is expanded, thus forcing the metal to bind against the blades. The design at **B** employs pins that are flattened on one side and arranged so that they fit into the head, adjacent to the blade, on a taper. When the pins are driven into place, they hold the blades firmly. When using this type of head, the pins should never be set at the rear side, but always on the cutting side of the tool. At **C** is shown another method of using a pin, which is beveled off on one side and fitted into a hole drilled at a slight angle to the cutting face of the tool.

In the design shown at **D** a screw is used to hold the blade in place, and if the reamer body is long enough, it is possible to use two, three, or four screws. At **E** is shown a blade made with a groove in it, into which a pin is driven. The hole is drilled in the body on a slight angle, so that a binding action takes place when the pin is inserted and driven into place. The reamer blade shown at **F** has counterbored holes, so that fillister-head screws can be used to hold the blades in place. This design is used frequently, although the cost of the blades is rather high. The design, however, lends itself to the use of cemented tungsten carbide tips, which, of course, would be brazed onto a carbon steel body.

The design at **G** shows a method of holding a blade in which a tapered block is used that fits into a groove adjacent to the blade, arranged so that an angular side of the block strikes a corresponding surface on the back side of the blade. At **H** is shown a method of holding two blades with one clamp. The blades are made with milled grooves to take the ends of the clamp. The tool shown at **K** is a self-locking type of blade made with two angular faces, so that when the blade is driven into the body, it has a tendency to bind itself. The dimensions of both the blade and the slot must be held to very close limits.

At **L** is shown another design in which a tapered pin and slot are employed, arranged so that the blade is held securely when the pin is driven into the body. This design is a variation of the design shown at **A**. The

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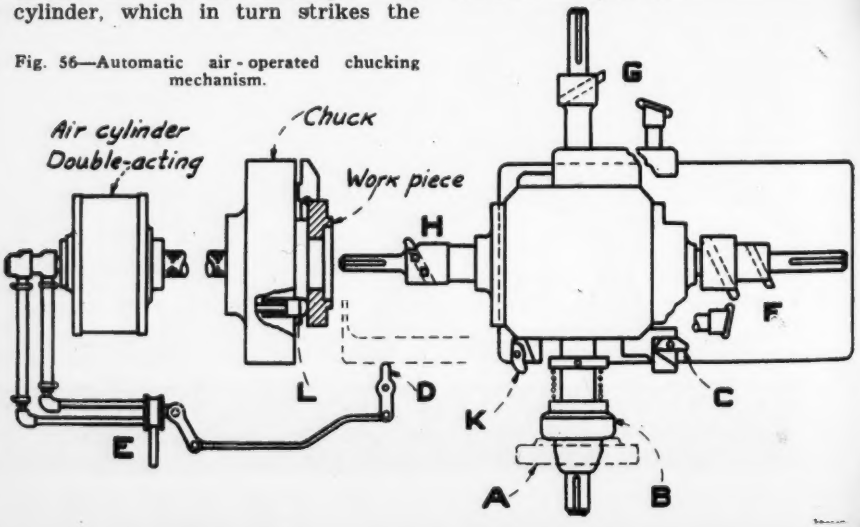
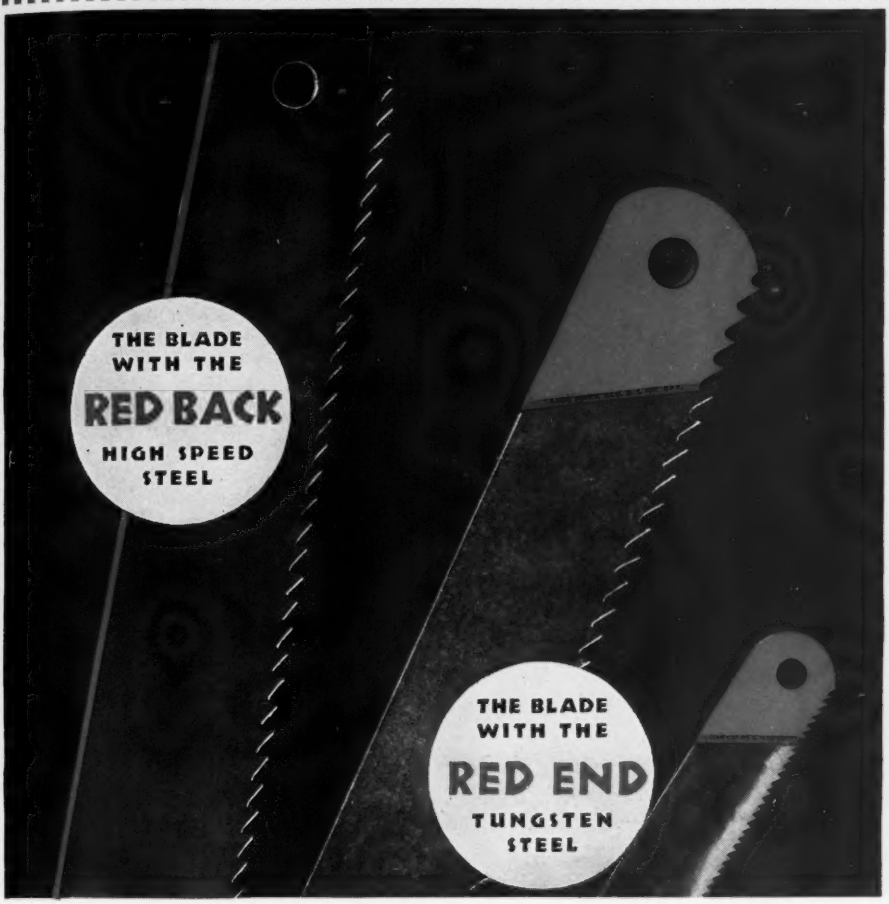
design **M** uses a block similar to that shown at **G**, although the angular face is made at the opposite side and the block is placed in from the end rather than from the top. Another method of inserting blades in a reamer head is by brazing as shown at **N**. This design lends itself more readily to blades tipped with cemented tungsten carbide. It is possible to braze high-speed steel into a carbon steel body and then harden the blades after brazing. The process is inclined to be difficult, however, and is not recommended unless a full knowledge of brazing is available.

The use of air-operated tools for holding work that is to be bored is becoming general in production plants. In Fig. 55 is shown an air-operated clamping device for the machining of car brasses. The clamping device consists of an air-cylinder mounted on the center support of the machine, which, of course, can be operated independently. Contrary to the usual practice, however, the plunger of the air cylinder remains stationary and the cylinder itself moves vertically when the air is engaged. Two clamping blocks placed opposite to one another are attached directly to the cylinder, which in turn strikes the work-piece on the downward stroke.

A rather unique method of clamping a forging in a pneumatically-operated chuck is illustrated in Fig. 56. The clamping action is semi-automatic, since it is only necessary for the operator to place a rough forging on the turret bar as at **A**. When the turret indexes, the work is presented to the chuck, which, of course, is open. The work strikes the locating faces of the jaws, then as the turret continues to travel, the work remains stationary and the work support **B**, which is spring-operated, continues to move inward. The finger **C** attached to the face of the turret strikes the lever **D**, which engages and opens the air valve **E**, thus causing the chuck to grip the work. The turret then withdraws, indexes, and the boring bars shown at **F** and **G** are brought into service. After the finish boring bar **H** has passed through the work, the turret continues to travel inward until the trip **K** strikes the lever **D**, causing the air pressure to be released. Three plungers, as shown at **L**, then cause the workpiece to eject onto the back end of the bar **H**, from which it is removed at the convenience of the operator.

Fig. 56—Automatic air-operated chucking mechanism.





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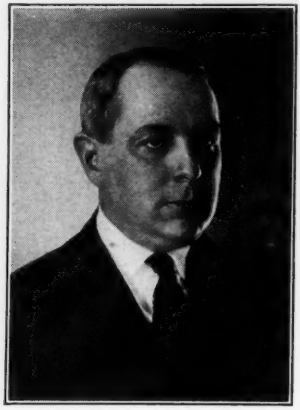

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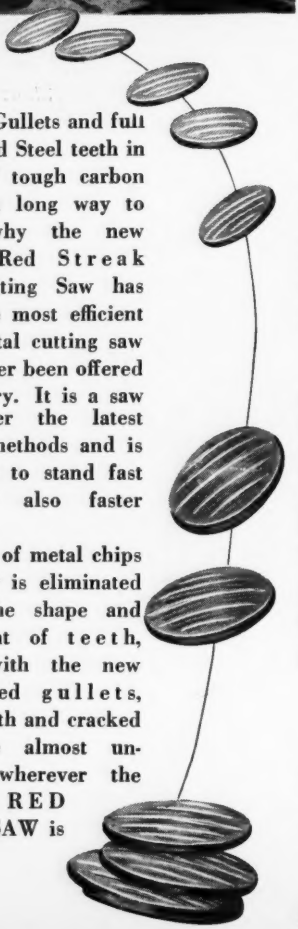

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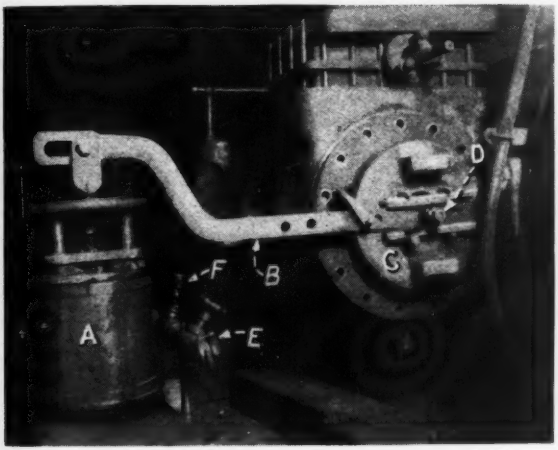
By H. H. HENSON

ALTHOUGH the grinding-in of locomotive cylinder heads by hand is rapidly becoming a thing of the past, there are undoubtedly many shops where a machine for performing this operation would be welcome. The equipment shown in the illustration can be assembled at small cost, and will grind-in the average cylinder head in from two to three hours.



Portable cylinder head grinder in action.

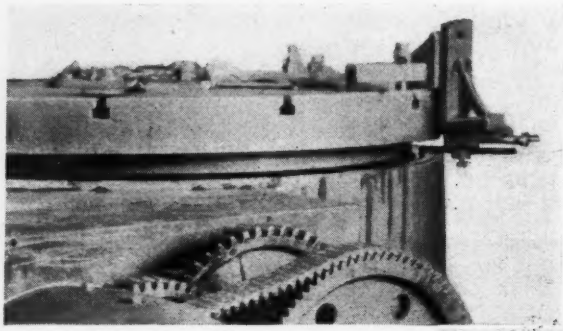
The machine consists primarily of the steam end of a 9½-in. Westinghouse air pump, **A**, mounted on a heavily-constructed truck or "wagon" made from heavy channel iron, together with a connecting rod, **B**, which transmits motion from the piston of the air pump to the head, designated as **C**, which is to be ground-in. It is essential that the truck be heavy, so that it will not only provide a firm support for the cylinder, but also so that it will maintain its position during the grinding operation. The leverage exerted by the up-and-down movement of the connecting rod would, of course, move a lightly-constructed truck out of position.

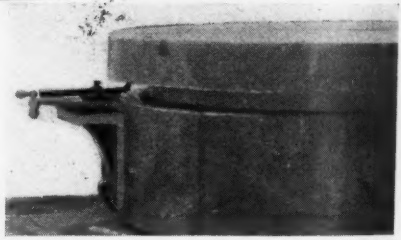
The cylinder **A** is bolted to a cast iron bracket which, in turn, is bolted to the channel iron base, as shown. A hole 12 inches in diameter is cut in the channel iron, allowing the valves of the cylinder to project so that they will be accessible in case repairs or adjustments are necessary. The cylinder head is held in place by a rod **D**, which extends through the head and through the cylinder to the rear end, where it is anchored to a crosspiece. A heavy spring under the nut at the rear end of the rod provides the necessary tension. Crushed steel and lubricating oil are used on the surface to be ground-in.

The machine can be operated by either air or steam, the power line being connected to the hose coupling **E**. The speed of the machine is regu-

lated by a globe valve located just back of the hose coupling. Lubrication is provided by the oil-cup F, placed in the inlet pipe.

The channel which forms the platform of the truck is ¾ in. thick, 15 inches across, and 42 inches long, with 3½-in. sides. The 12-in. diameter hole is exactly in the center. The connecting rod **B** is of ¾ x 2½-in. iron, and is 52 in. long after forming. The end that connects to the cylinder has a $1\frac{9}{16}$ x 5¾-in. opening, as shown. This end is also forged to a thickness of 1 inch. When not in use, the rod folds back across the truck, out of the way. The machine shown in the illustration has been in use six years and has required repairing only once during this time.





(Above)—Facing lower bearing face of boring mill table. (Right)—Facing upper face of ways.

Repairing a Boring Mill Under Its Own Power

By S. N. Smith

THE accompanying photographs illustrate the methods employed in our shop to repair a boring mill under its own power. The ways were so badly worn and scored that facing was necessary, but unless we could discover means for performing the operation ourselves, the mill would be out of commission for probably several weeks and a great deal of expense would be involved.

We removed the crossrail and housing, which were also to be given a thorough overhauling, leaving the base and table together with the motor and power transmission equipment. We then hoisted the table and placed a brass washer, 4 inches thick, under the spindle, raising the table enough so that a boring tool could be inserted between the lower bearing face of the table and the upper bearing face of the ways. As the pinion that drives the table has a 6-in. face, 2 inches was left to do the driving.

We first bolted an angle plate to the table at the edge so that a second angle plate could be bolted to it to provide a seat for the tool block. A lathe toolslide was then bolted to the second angle plate in an upside down position and a boring tool was clamped in position with the point down, as shown in the illustrations. With the machine table running by power, the face of the ways was machined smooth.

We then removed the tool and bolted one of the angle plates to the side of the mill so that the toolslide could be anchored to it, right side up, as

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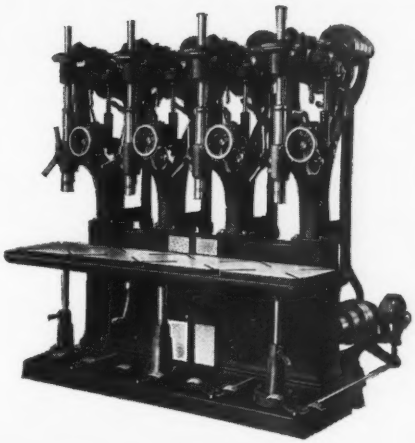

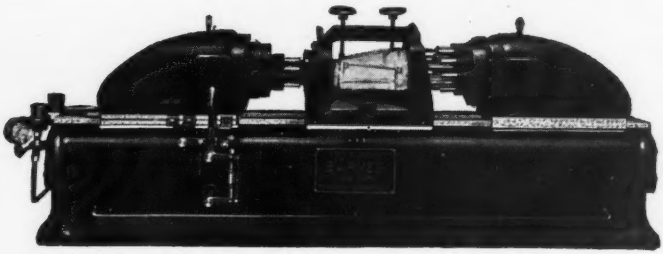

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Horizontal Duplex Heavy-Duty Drilling and Reaming machine illustrated above.

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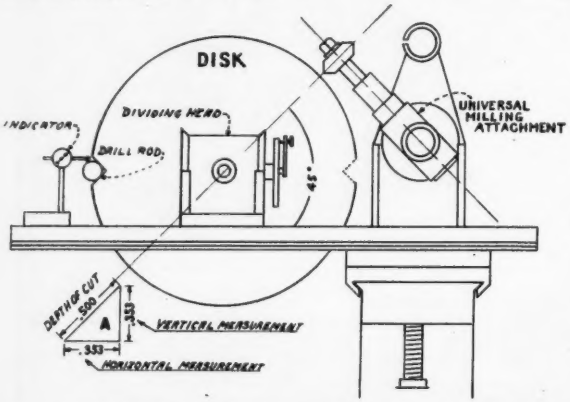
shown. With the point of the tool pointing upward, we again applied the power and faced the lower bearing face of the table. The whole operation took but a few hours and a first-class job was obtained at small cost.

An Oversize Milling Job

By CHARLES KUGLER

THE writer was recently confronted with the task of milling 48 notches in the periphery of a disk which was so large that it seemed, at first, impossible to do the job on the only available milling machine. By using a Universal Milling Attachment, however, the job was completed in a satisfactory manner.



Drawing showing how a Universal Milling Attachment was used to mill notches in a large disk.

The attachment was swung about so as to bring the axis of the cutter on an angle of 45 degrees from the plane of the table, as shown, then the disk was clamped to the face plate of a dividing head on the table. Before proceeding with the operation, it was necessary to center the cutter with the disk, which was accomplished as follows:

A line was inscribed across the center of the disk and the cutter was centered as accurately as possible by the eye, then a small notch was milled, the disk was revolved 90 degrees, and another small notch was milled. The amount of out-of-center of the notches was then found with the aid of a dial indicator, and the necessary adjustment was made. A piece of drill rod, placed in the notch, aided in indicating. When the indicator readings were exactly alike, the cutter was central.

After aligning the cutter with the center of the disk, the cutter was set to the correct depth—.500 in. —by raising the table .353 in. as shown at A. The success of the method used in this instance suggests the possibility of using it for cutting large gears or for machining other parts that are too large to be handled in the average machine.

Link Radius Milling Fixture

By H. H. HENSON

THE fixture shown in the accompanying illustration is used for milling the radii in locomotive links or other radial parts within its range. The fixture is so designed that it can be bolted to the table of a milling machine, as shown, and may be adjusted for milling links of different radii.

The fixture consists principally of a cast iron body **A** upon which are mounted two guide-bars **B** and **C**. The inner or adjoining ends of the guide-bars are pivoted on the capscrew **D**, and the outer ends of the bars are anchored in place, after the correct adjustment is obtained, by means of studs through the slots **E** and **F**. The

(Continued on page 68)

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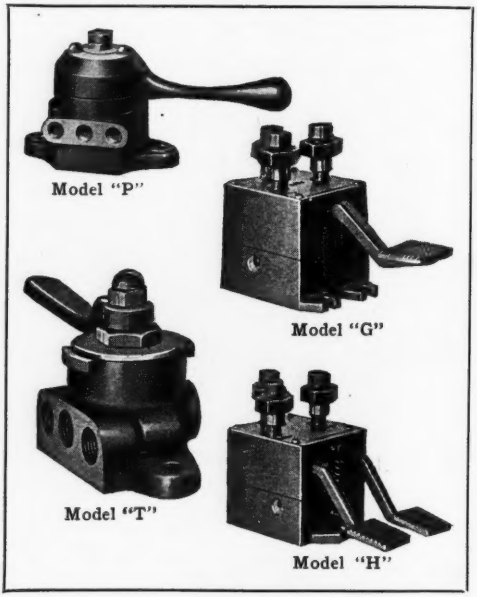

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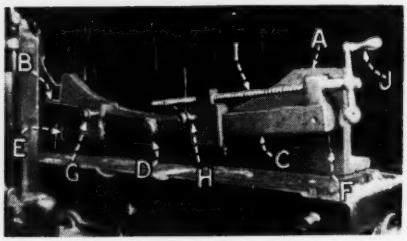
Link Radius Milling Fixture

(*Continued from page 64*)

link is held in position on the fixture by the studs **G** and **H**, which fit into the holes in the ends of the link. These studs are located in sliding blocks which are fed along the bars **B** and **C** by the feed-screw **I**, operated by a gear where the handle **J** is shown, the gear meshing with gears in the feed mechanism of the table. The handle **J** is used when setting up and adjusting the fixture, but when ready for operation, the handle is removed and the gear is put on. A greater or smaller radius can be obtained by raising or lowering the ends of the guide-bars **B** and **C**.

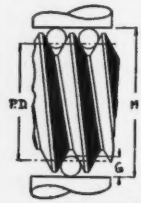
The cast iron body, **A**, is 50 in. long and 12¾ in. high, with a bottom face 10⅝ in. wide. The faces are 1 in. thick and the three ribs, which are located at the ends and center, are each 1¼ in. thick. The slots **E** and **F** are each 31/32 in. wide by 7 in. long, with the inner edge of the slot on a 10-in. radius from the center of the hole



Link Radius Milling Fixture.

which holds the ⅞-in. cap screw **D**. The feed-screw **I** is 31¼ in. long with a ⅜ in. collar located 4⅞ in. from the outer end. With the exception of 1½ in. which serves as a bearing, the long end of the screw carries a 1¼ 8 P. square thread for which a corresponding thread is cut in the block attached to the sliding block carrying the stud **H**. Two inches of the short end are 1¼ in. diameter for the gear, and a ¾ 10 thd. stud on the end provides for the handle. When ready to apply power, a worm wheel is placed on the feed-screw and a worm is attached to the table feed gears, the worm and wheel being of a size to suit.

Thread Measuring Wires



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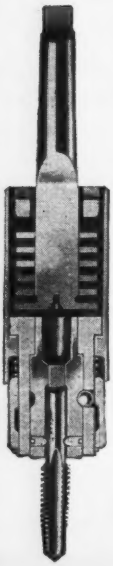

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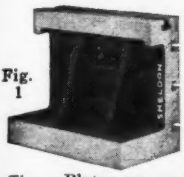


Fig. 1

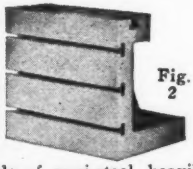


Fig. 2

These Plates are made of semi-steel, heavily ribbed, insuring close-grained, rigid castings.

With Second Face and T Slots

No.	Size Face	Size Top	Size Base	T Slots	Wt., Lbs.	Price, Each
1T	3¾ x 5	1½ x 5	2½ x 5	4–¼"	5	$10.00
2T	6 x 7	2½ x 7	4½ x 7	4–½"	20	15.00
3T	8 x 9	3 x 9	6 x 9	4–½"	38	20.00
4T	10 x12	3½ x12	7¾ x12	4–⅝"	75	30.00
5T	14 x16	4 x16	9 x16	4–⅝"	170	45.00

SHELDON 90o PLAIN ANGLE PLATES

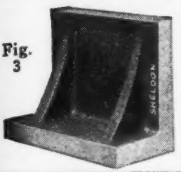


Fig. 3

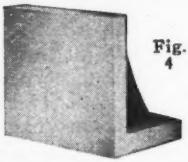


Fig. 4

No.	Size Face	Thickness Face	Size Base	Wt., Lbs.	Price, Each
1P	3¾ x 5	½	2½ x 5	4	$ 8.00
2P	6 x 7	¾	4½ x 7	15	10.00
3P	8 x 9	1	6 x 9	30	14.00
4P	10 x12	1¼	7¾ x12	60	20.00
5P	14 x16	1½	9 x16	145	30.00

Sheldon "Set-Up" Jacks

Fig. 1 Planer Jack

Fig. 2 Vertical Jack

Fig. 3 Bracing Jack

PLANER JACKS (Fig. 1)

No.	Height, Contracted	Height, Extended	Diam., Screw	Weight, Lbs.	Price, Each
1	2¾	3¾	⅞	1½	$1.25
2	3¾	5¼	1⅛	3	2.10
3	5¼	7½	1¼	6	3.00
4	7½	12	1½	12	6.00

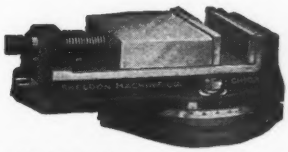
VERTICAL JACKS (Fig. 2)

1	2¾	4	⅝	1½	$ .75
2	4	7½	⅞	2	1.10
3	6¾	12	¾	5½	1.70
4	8¾	15	1	7	2.50

BRACING JACKS (Fig. 3)

1	3¾	6	⅝	1	$ .65
2	4¾	8	⅝	2	1.00
3	6¾	12	¾	3	1.50
4	8¾	16	⅞	4	2.10

Sheldon Milling Machine Vises



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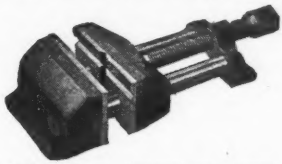
SPECIFICATIONS AND PRICES:

No.	Width of Jaws	Depth of Jaws	Jaws Open	PLAIN VISE Wt., lbs.	PLAIN VISE Price	SWIVEL VISE Wt., lbs.	SWIVEL VISE Price
3	3½"	1⅜"	2½"	15	$16.00	25	$20.00
4	4½"	1⅝"	3½"	30	$20.00	45	$24.00
6	6½"	2 "	4½"	70	$30.00	90	$40.00
8	8½"	2½"	7 "	160	$45.00	225	$60.00

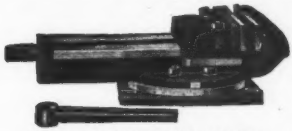
Sheldon Drill Press Vises



Guide Bars are Hardened and Ground.
SPECIFICATIONS AND PRICES:

No.	Width of Jaws	Depth of Jaws over Guide Bars	Full Depth of Jaws	Jaws Open	Wt., lbs.	Price
D 4	4½"	1⅝"	3"	4"	15	$12.00
D 6	6½"	1¾"	3½"	6"	35	$18.00
D 9	9 "	2½"	4½"	9"	70	$24.00

Sheldon Shaper Vises



SPECIFICATIONS AND PRICES:

No.	Size of Jaws	Vise Opens	Bolt Hole Spacing*	Wt., lbs.	Price
1	12" x 2½"	12½"	7½"	175	$120.00
2	14" x 2¾"	13½"	8½"	240	$135.00

*Distance between holes can be changed without additional charge.

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Over the Editor's Desk

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IT is reassuring that, with all the thought and effort that is being expended upon the development of means and methods for producing at continually-increasing rates of speed, the factor of safety is fast becoming the first and most important consideration. The attitude of modern industry toward its workers is "Work efficiently, but above all, WORK SAFELY."

The importance with which the necessity for safety has come to be regarded is indicated by the preparations that have been made for the forthcoming meeting of the National Safety Council, which will hold its annual conference in Pittsburgh from September 29th to October 3rd. The program is divided into 116 sections, which will convene at 140 sessions to hear more than 380 speakers, all of whom will discuss topics that bear upon the matter of safety. Every phase of safety in industry will be covered; every possible hazard will be dwelt upon together with means—both actual and proposed — for remedying the evils.

In addition to the regular sessions, there will be eleven special sessions, each of which will be addressed by a speaker of special qualifications. Among the speakers will be an eye specialist of national reputation, the general superintendent of the Homestead Works of the Carnegie Steel Company, the medical directors of several of the nation's largest industries, an expert from the U. S. Bureau of Mines, and others as prominent.

It will be practically impossible for anyone to attend this conference without carrying away with him a keener appreciation of the effort that is being made to make the job safe for the worker.

A Little Head-Work Pays Dividends

IN a recent group discussion of the various kinds and types of systems used to keep track of material, time, and so on, one of the group bewailed the fact that most systems are "so complicated." He was probably referring to all systems excepting his own. We all have our own methods and systems—crude as they may be. No man who is running a plant of any size today can get along without certain reports at regular intervals, and no plant can function properly without a cut-and-dried method of handling its business between departments and between the departments and the office.

The fact is that any system seems more complicated than the one with which we are familiar, and even the most simple system seems complicated when an attempt is made to describe its workings in detail on paper. This statement may easily be verified by anyone who will attempt to write out a detailed description of any plant system with which he is acquainted. Still, an intelligently-written description of the average system is not hard to understand—it only looks that way. Any person who will take the trouble to follow in detail the workings of any modern system as explained by a well-posted writer can not fail to absorb some ideas that can be used. He will at least undoubtedly start a train of thought which may lead to the bettering of some of the systems in use in his own plant.

Simple . . .
Effective . . .
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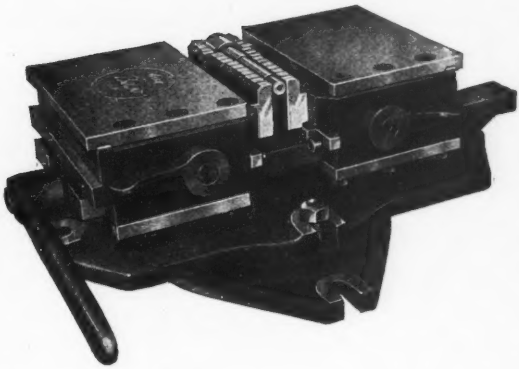

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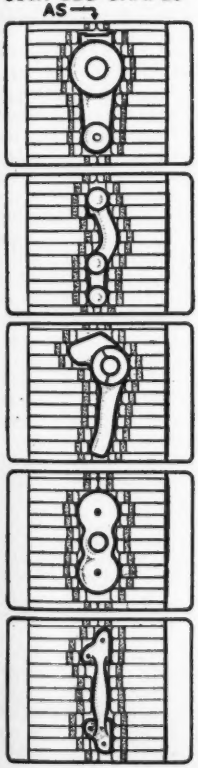

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New Shop Equipment

Diamond "Type G" Surface Grinding Machine

A high speed, hydraulically-driven surface grinding machine designed especially for finishing such parts as dies, punches, thrust collars, spacers, flat and formed cutters and other similar pieces has been placed on the market by The Diamond Machine Company, 17 Codding Street, Providence, R. I. The machine, which is known as the Type G, will grind work 7½ in. wide, 22 in. long, and 9 in. high beneath a 10-in. diameter wheel.

Diamond "Type G" Hydraulic Drive Surface Grinding Machine.

The machine consists principally of a rectangular-shaped bed, wheel head and elevating feed mechanism, V-belt driven spindle and abrasive wheel, saddle and cross feed mechanism, and the table with a hydraulic drive mechanism which also operates the power cross feed. The bed is a single casting, complete with vertical ways which carry the wheel head and horizontal V-ways which guide the saddle. The wheel head ways extend from the floor to a point above the horizontal bed of the machine, insuring rigidity and alignment. The wheel head is held rigidly against the bed by seven bolts through the gib, and an equal number of adjusting screws are provided for adjustment for side play. The oil reservoir, oil pump and control mechanism, coolant reservoir, sediment tank and coolant pump are all located within the bed casting.

The wheel head is cast integral with the spindle housing. All of the ways are carefully fitted to insure accurate grinding. The elevating feed mechanism is provided with a coarse feed elevating handwheel on the front of the bed with which the wheel head may be rapidly raised or lowered, and an elevating micrometer feed hand wheel, located to the left and slightly above the abrasive wheel, which is used for accurate vertical down feed. With the coarse feed elevating handwheel, a feed of .125 in. per rev. is obtained. The elevating micrometer feed wheel is graduated to .00010 inch.

The overhang of the spindle housing (distance from abrasive wheel to wheel head ways) is much less than the length of the vertical ways. The spindle is hardened, ground, and mounted on ball bearings, eliminating any possibility of play. These bearings are protected by dust flanges and the thrust adjustment is taken at the driving end of the spindle.

The spindle is designed for a 10-in. diameter wheel with ¾-in. face and a 1-in. hole. Ample power and rigidity have been provided to insure accuracy and smoothness of finish with this size of wheel. The spindle is driven by a

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In every industry there is one product that is held up as the standard — specified by buyers who want to be sure of having "the best". The makers of Wetmore Reamers, through many years of exacting work, have placed the name "Wetmore" in this position. Today, the leading motor manufacturers specify "Wetmore" for reamers they *know* will give them the utmost in precision, finish, convenience of use, and long life. Send for latest catalog of all types of Wetmore Adjustable Machine and Cylinder Reamers.

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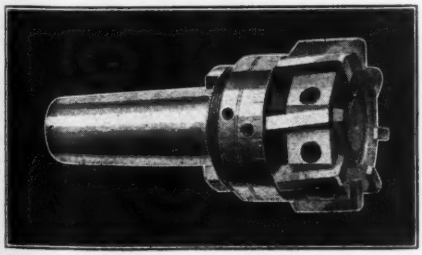
62 27th Street Milwaukee, Wis.



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The Roughing Reamer, with right-hand angle blades, is sturdily designed to withstand initial operation. Removes unusually large amount of stock. The Semi-finishing Reamer has left-hand angle blades which eliminate "digging in" and chatter. The Finishing Reamer, with left-hand angle blades and float-in-head design, gives a reaming action obtained by no other tool.

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1½ h.p. 1800 r.p.m. motor through a V-belt and sheaves, making a spindle speed of 2000 r.p.m. The motor is mounted on an adjustable base so that proper driving tension may be maintained in the V-belt, and the entire driving mechanism is covered by a cast guard.

The power crossfeed at each end of the table travel is operated by a hydraulic piston acting within a cylinder. Before any oil can enter the table cylinder, it must pass through the transverse travel cylinder, driving a piston which actuates the saddle. Since the oil must operate the feed before it gets to the table cylinder, the feed is completed at the moment of table reversal, thus eliminating shock. The saddle is limited in its travel by a limit switch with which the table drive motor may be stopped. The amount of cross feed is easily regulated, by means of a crossfeed crank, to produce a feed up to .125 in. per stroke. The crossfeed mechanism can be easily operated by hand, after the power crossfeed has been disengaged, feeding .400 in. per revolution of the wheel. The maximum crossfeed travel is 8½ inches.

The table ways—one V-way for alignment and one flat way—are carefully fitted to the saddle The table platen, which is 22 in. long by 7½ in. wide, is provided with three T-slots for ⅜-in. bolts on 2⅝-in. centers. The platen is carefully ground to insure accurate work. An ample drain, surrounding the platen, conducts the coolant to the saddle and thence to the sediment tank and reservoir.

The table drive mechanism is of the hydraulic cylinder and piston type, actuated by the pressure of oil pumped from the reservoir in the bottom of the bed. The saddle is connected to the pump by heavy flexible tubing which has been tested to 300 pounds, although the maximum working pressure will not exceed 125 pounds. The hydraulic pump and coolant pump sub-assembly are mounted on a plate bolted to the left side of the machine. With this type of drive, any table speed desired is instantly obtained by opening or closing table speed control valve. The table may be operated at a speed in excess of 50 ft. per min., and slower speeds are just as quickly obtained. The table ways are automatically oiled from the hydraulic drive system, insuring ample lubrication where most needed.

The floor space required, including maximum travel of the table, is 88¾ in. by 43⅛ in. Height, floor to table, 36¼

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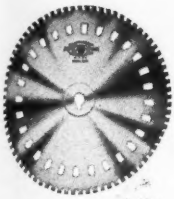

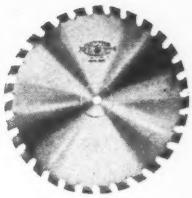

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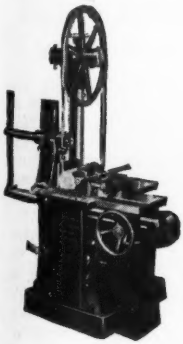

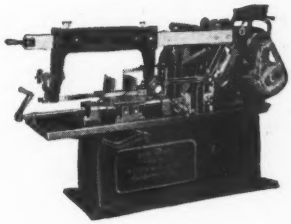

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402 South Illinois Street INDIANAPOLIS, INDIANA

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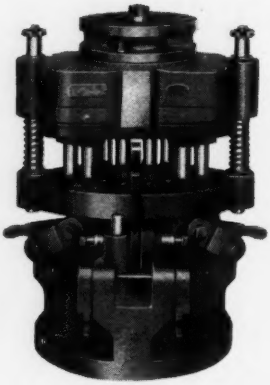

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SNYDER Tool Set-Ups produce such good results because they are carefully designed and built to suit EACH customer's particular requirements.

Here is a Snyder tool set-up for simultaneous drilling and reaming bolt holes in connecting rods. It consists of a Snyder eight spindle multiple head, bushing plate and three station work holding fixture.

This set-up illustrates the possibilities of converting a single spindle drilling machine into a multiple spindle high production tool. Investigate these possibilities in your shop—call on Snyder Engineers TODAY!

Snyder Tool & Eng. Co.

3400 East Lafayette Avenue

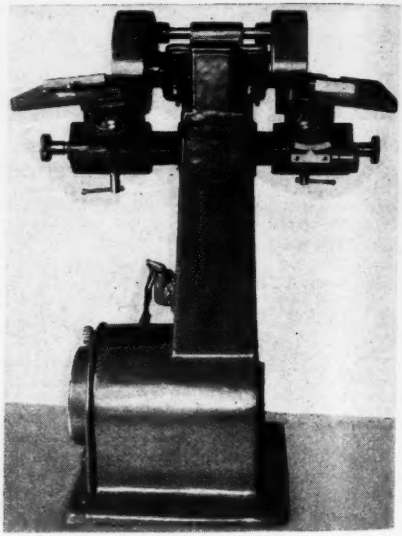
DETROIT, MICHIGAN

SNYDER TOOLS

in. Shipping weight, with motors, approximately 2,600 pounds.

Oliver Grinder for Tungsten-Carbide Tools

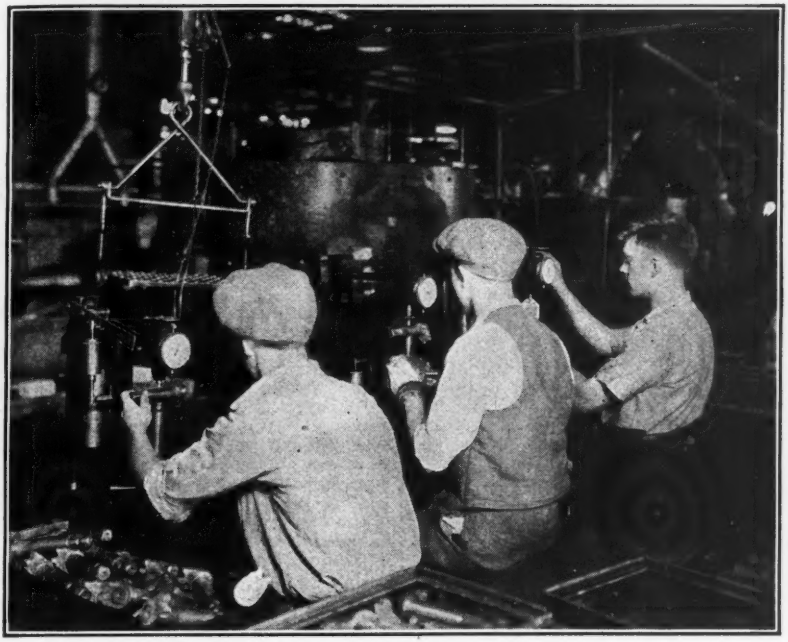
A tool grinder that is intended especially for the grinding of tungsten-carbide tools has been developed by The Oliver Instrument Company, 1430 Maumee Street, Adrian, Michigan. The machine is primarily a double-end grinding



Oliver Tungsten-Carbide Tool Grinder.

stand, mounting a grinding wheel on each end of the spindle and driven by a 1 h.p. motor located in the base of the pedestal. The wheels are 9-in. cup wheels with 2-in. face. The double construction permits the complete grinding of all angles on a tool without the necessity of changing wheels.

The grinding is done "free-hand," the tool being held against a protractor to obtain the correct angle. The grinder is equipped with a table for each wheel, the table being adjustable to the wheel by means of hand knobs. Clamping screws provide for locking each table in position. The top of each table has a guide slot parallel to the wheel face, with a protractor sliding in this slot to guide the tool accurately to the face of the wheel. The tables are graduated to tilt to 25 degrees, and the protractor is



Rockwell Hardness Testers at the Gemmer Mfg. Co., Detroit

Facts

a—**Rockwell Testing** can be done in the hardening room as accurately as in a laboratory.

b—The selected load in a Rockwell Test is applied by a dead weight and lever so that the operator is never concerned with any pressure gauge readings.

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Patented July 8, 1918
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NOTHING can equal the original ETCHOGRAPH. Six stages of heat—no other machine has this feature — give a wide variation in the size of marking. Simple operation—write as you would with a pencil. Just plug in on any light circuit — mark any material—iron, steel or steelite. If tool marking alone is desired, the JUNIOR ETCHOGRAPH with two heats only will do your work.

Write for quotation, stating power available.

William Brewster Company

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graduated up to 50 degrees either side of center. This arrangement makes it possible for an operator to grind a tool, quickly and accurately, to the exact angle required.

The spindle of the machine is of a special grade of heat-treated steel, running in bronze bearings, and is easily adjusted for wear. The bearings are lubricated from oil wells by means of a wick. The spindle construction provides a solid and vibrationless mounting for the wheels, which is essential in grinding tungsten-carbide tools. The wheel guards are adjustable to compensate for wear.

The motor control is of the push button magnetic type with overload and undervoltage protection. The grinding wheels can be run in either direction, for grinding either right or left-hand tools. The machine, when shipped, is completely equipped for operation, equipment including a motor, grinding wheels, protractor, belt, starting switch, and a diamond dresser which is made to slide in the slot in the table, assuring the tool guide always being square with the wheel face. The weight is 600 pounds.

Murchey Precision Threading Machine No. 98

To meet an increasing demand for a machine which will produce "cut" threads of extreme accuracy on a production basis, with a minimum of spoilage, the Murchey Machine & Tool Company, 951 Porter Street, Detroit, Michigan, has brought out the Murchey Precision Threading Machine No. 98. The machine is designed to use the Murchey Self-Opening Type "CO" Die Heads or Murchey Collapsible Taps. A lead screw that is hardened and ground to within .0001 in. per inch of lead is mounted directly on the spindle of the machine, insuring accurate alignment of the

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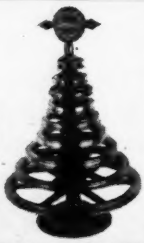

All Size Holes

Pulley Diam. inches	Size of Holes inches
2½	⅜ ½ ⅝
3	½ ⅝
4L	⅜ ½
4	½ ⅝ ¾ 1
5	½ ⅝ ¾ 1
6	½ ⅝ ¾ 1
8	½ ⅝ ¾ 1
10	½ ⅝ ¾ 1
12	½ ⅝ ¾ 1

Special Holes Bored

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Combine Operations!

Combining operations always results in time savings and lower costs. The Connecticut combination round and spline broach obtains these results by broaching the drilled hole to size, cutting the splines, and removing the burr *in one operation*. Besides, the accuracy of the job is improved.

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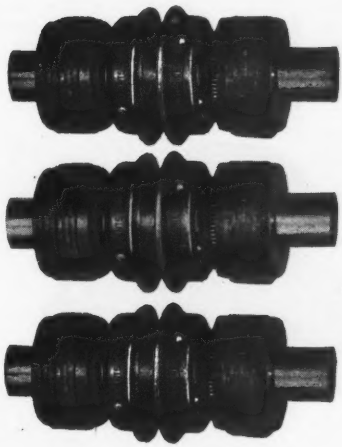

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In addition to sending you full descriptive matter on this new and most efficient clutch, if you will send us details of any installation you may have in mind, our engineering department will be glad to submit their recommendation applying directly thereto, gratis.

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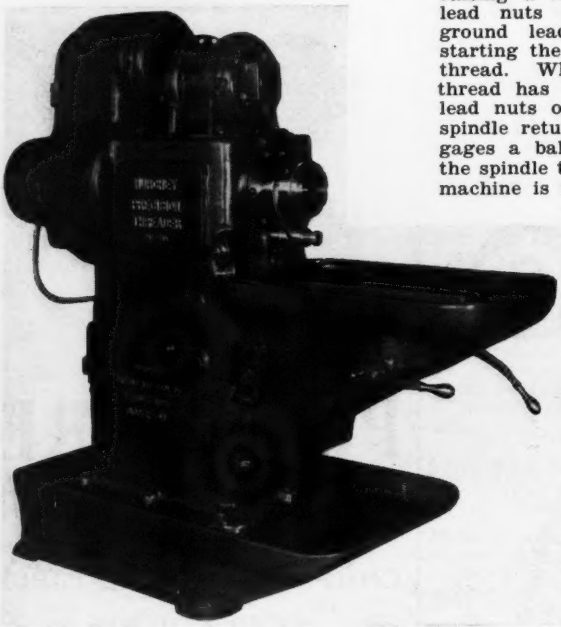
MMS-10

"chasers" used in cutting the thread. There are no gears or keys to destroy this lead.

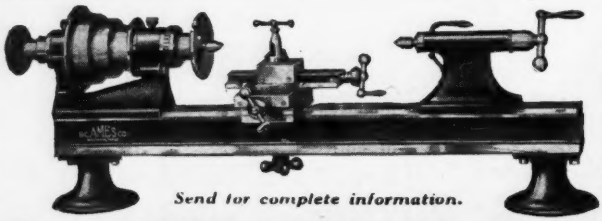
The machine is motorized, being built as a unit with two motors. A 3 h.p. 1800 r.p.m. motor is used to drive the machine and a ½ h.p. 1800 r.p.m. motor drives the pumps and return worm shaft. The machine is lubricated by a combination force and flood system, the cutting compound being forced under pressure through the spindle. The coolant and lubricant reservoirs are located in the base of the machine.



Murchey Precision Threading Machine No. 98.

The operation of the machine is as follows: The machine is placed in motion by pressing a switch button located on the left side of the machine. By raising a lever handle, the segmental lead nuts engage the hardened and ground lead screw, this engagement starting the spindle forward to cut the thread. When the desired length of thread has been cut, the chasers and lead nuts open automatically and the spindle return worm automatically engages a ball thrust bearing, returning the spindle to its starting position. The machine is now ready to be started on a new cycle of operations. Stops are provided to determine the length of the thread to be cut.

Different diameters may be cut, with corresponding changes in speeds, by the use of the correct combination of pick-off gears. The construction of the machine makes the lead screw, segmental lead nuts, chasers, and pick-off gears so accessible that the machine can be completely changed in not to exceed thirty minutes' time. The motors are provided with magnetic reversing switches, making it possible to operate the machine either right or left hand. The spindle obtains its drive through two hardened and ground rollers, rotating in longitudinal grooves four inches from the center line of the spindle, thus reducing friction to a minimum. Anti-friction bearings are used throughout.



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DETROIT BRANCH: 902 STEPHENSON BUILDING

SKINNER COMBINATION GEARED SCROLL CHUCKS

IRON BODY

Figure 8500—Four-Jaw
WITH SOLID REVERSIBLE JAWS

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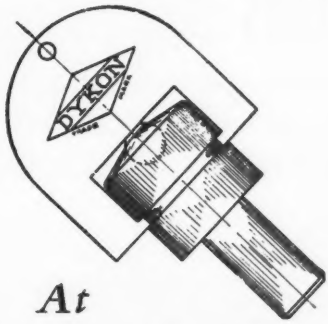
AN amazing number of people are apt to think that "chucks are chucks"—or more often, they give their chucking equipment no thought at all so long as it continues to work after a fashion. In fact, many otherwise up-to-the-minute producers are guilty of using worn, old model chucking equipment on new and expensive machines—getting less than maximum efficiency because of let down in a comparatively inexpensive part.

Your modern machines need modern chucks—Skinner Chucks—for most profitable service. Examine your chucking equipment today.

THE SKINNER CHUCK COMPANY

NEW BRITAIN, CONN U.S.A.

Precision Grinding



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TO OBTAIN precision grinding at reasonable costs—you must keep your precision grinding wheels smooth and true.

And, scores of leading manufacturers have found that the use of Koebel-Wagner diamonds is the best means of keeping their grinding wheels in first-class condition—because their costs are lowered and results improved.

You, too, can increase the efficiency of your precision grinding wheels with Koebel - Wagner Diamonds. Let us show you how — send the coupon today.

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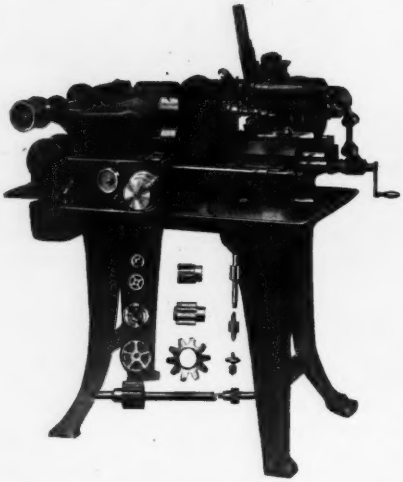
HOB your small pinions, gears, ratchet wheels, etc.

On Our KOEPFER

FULL AUTOMATIC HOBBING MACHINE



THIS machine has a fully automatic cycle of operation and on pinions is equipped with a MAGAZINE loading attachment.

The HOBBING process generates a theoretically correct tooth form and indexes the teeth uniformly accurate. It results in better work of greater PRECISION as well as greatly increased production.

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George Scherr Co.

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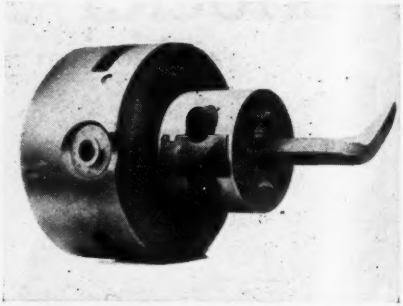
Casler Offset Boring Head

Sole distribution of the Casler Offset boring head, designed and manufactured by Herman Casler, Canastota, N. Y., has been taken over by Westcott Chuck Co., 124 East Walnut Street, Oneida, N. Y. Three models of these Casler boring heads are manufactured, of which the Style A is illustrated. It is claimed to combine all the essentials of a complete tool for boring and counterboring holes to size, and is rigid and compact. Furthermore, it can be adapted quickly to cover a wide range of work from the smallest to the largest size holes. It is designed to be threaded to the nose of the machine tool spindle, although it can be mounted on a taper shank to fit the spindle if desired.



Casler Style A Offset Boring Head

The Style A is manufactured in five different sizes with drill chuck capacities of from ⅛ to 1½ in., inclusive. When using the boring bar, the drill chuck is removed from the boring head and the bar is threaded into the offset plate. When in position to bring the cutting tool in line with the offset movement, it is clamped solid with a winged nut. The cutting tool is placed in a hole

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FREE FOTO GUIDE and Vacuum Cleaner Parts Catalog. Most complete ever published. Lists over 800 items and special tools. 24 pages. Illustrated. Standard material at lowest cost. Valuable source data on obsolete parts. Big help to all repair shops.

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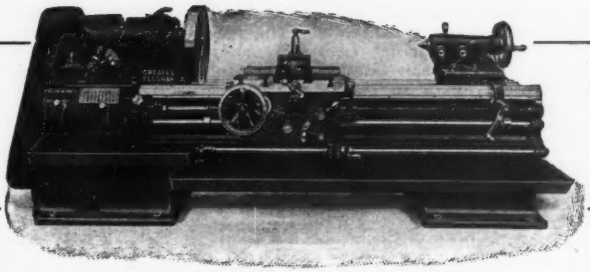


Belt or Motor Drive

This G. K. Feature Prevents Chatter!

G.K. Single Lever Control Lathes are designed with an offset between the spindle center and the center line of the bed.

This feature prevents tool chatter and buckling because it insures the correct angle for tool pressure on all work. Even on the larger diameters tool pressure re-acts on the inside of the front vee.

Let us outline all the advantages you get in a G.K. Lathe. Write for a Catalog.

The GREAVES-KLUSMAN TOOL COMPANY

CINCINNATI, OHIO

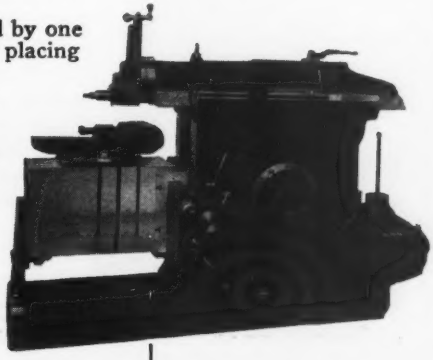
THIS SHAPER
Saves Valuable Time!

TIME is valuable — every non-productive minute runs up operating costs. The COLUMBIA "Superior" SHAPER saves time because its many features simplify your shaping problems.

Centralized control, cross rail locked by one handle, extra large table to facilitate placing and clamping the work, quick-stroke adjustment, patented quick-change feed, convenient and substantial table support are among the features which enable Columbia Superior Shapers to give such highly satisfactory service on all classes of shaper work.

Bulletin 17 outlines many more features — write for it today!

Columbia SUPERIOR



THE COLUMBIA Machine Tool Co.

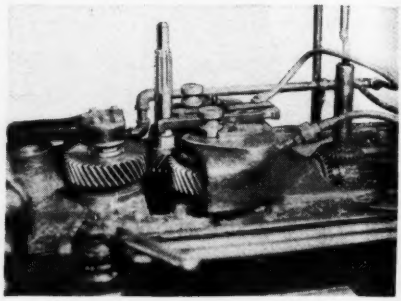
HAMILTON -:- -:- OHIO

at the end of the bar and held by a wedge-shaped pin driven in at the side. The diameters of these boring bars range from 1 to 3 in., and the lengths of holes bored range from 6 to 18 in., with diameters of from 1 1/8 to 8 1/8 inches.

The Style C boring head will take drill sizes from 5/16 to 3/8 in., the offset being 1/8 in. A straight shank is provided. Style F offset boring heads will take drills, reamers, or counterbores with shanks up to 3/4 in. in diameter. An offset of 3/8 in. can be obtained with either round or hexagon tools up to 5/16 in. in diameter, while an offset of 1/2 in. is obtained with round or hexagon boring tools up to 1/4 in. in diameter. This particular boring head can be equipped with a taper shank and mounted on milling machine for drilling, reaming, and boring holes to size in jig, fixture, and gage work. It is also suitable for undercutting and recessing when mounted in a turret lathe.

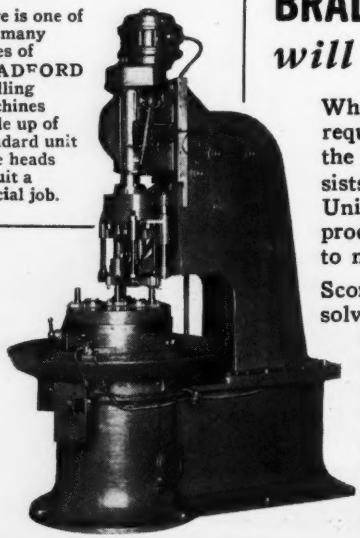
Spiral Gear Attachment for Bolender Gear Burnisher

Spiral gears can now be burnished in the Bolender Gear Burnisher as efficiently as spur gears, by the use of an attachment which has been placed on the market by the City Machine & Tool Works, June and East Third Streets, Dayton, Ohio. Heretofore the burnishing of spiral gears has been difficult due to the fact that spiral gears, when burnished under load, tended to crawl out of position. When burnished in one direction a downward thrust was set up, and when burnished in the other direction, an upward thrust was set up. The



Spiral gear attachment for Bolender Gear Burnisher.

Here is one of the many types of BRADFORD Drilling machines made up of standard unit type heads to suit a special job.



BRADFORD Drilling Machines
will solve your problem!

When you have a special drilling job which requires a special machine . . . investigate the BRADFORD Drilling Machine. It consists of one or more BRADFORD Standard Unit Type heads assembled into one high production unit and mounted at any angle to meet your special requirements.

Scores of manufacturers have not only solved drilling problems . . . but also hollow milling, countersinking and tapping problems with these machines. They obtain a better job . . . in less time . . . and at lower costs.

Let us show you what such a BRADFORD Machine will accomplish in your shop. Send us blueprints or samples of your work TODAY.

BRADFORD MACHINE TOOL CO. 659 EVANS STREET CINCINNATI, OHIO

15 Union Hoist Safety Features

Protect Your MEN

Model "A"—1-Ton Capacity. Made in 12 sizes from ½ to 20 tons.

Shopmen — those who know hoists—prefer Union Hoists. Their preference is based on the fifteen points of superiority in the Union design.

Among these features are:

Reversible Load Sprocket.

All-Steel Suspension.

Solid Alloy Steel Load Shaft on roller bearings.

Electric Welded Tested Chain.

Forged Steel Hooks.

Also each hoist is tested to 150% of its rated capacity.

The above and others we will name make the UNION Hoist a winner in any shop.

Also Makers of

Union Chucks

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It Looks Easy *But....*

....it is ***impossible*** to grind a drill or tap correctly by hand. However, here are two machines with which you can do the job perfectly.

The first is the GRAND RAPIDS TAP GRINDER. All flutes of practically any right or left hand tap can be ground ***exactly*** alike with this machine in less time than is required by any other method.

Grand Rapids Tap Grinder

The other is the GRAND RAPIDS DRILL GRINDER. With this machine only one adjustment is necessary to change from one size drill to another—that of the tailstock to accommodate the length of the drill. The drill is always placed ***automatically*** in the machine at the correct grinding angle.

Grand Rapids Drill Grinder

Then, there is the combination machine—suitable for grinding both drills and taps. Write for bulletins.

GALLMEYER & LIVINGSTON CO.

348 Straight Avenue, S.W.
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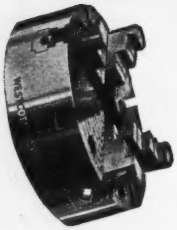
Westcott Chucks for Lathes and Drills



I.X.L. Independent Lathe Chuck

Combinations - Independents
Universals
Two-Jaw Round Body
Lathe Chucks
"Little Giant" Drill Chucks

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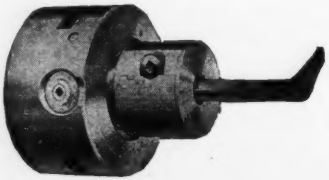

CASLER Offset Boring Heads

Reduce the cost of
Jigs - Fixtures
Experimental Work
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Westcott Chuck Co.

124 E. Walnut St., Oneida, N.Y.

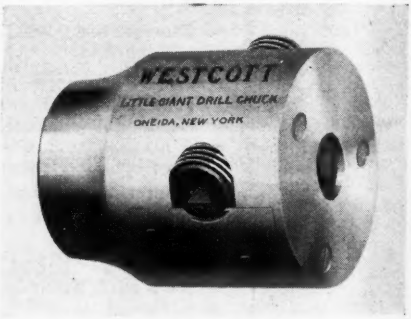
Manufacturers of Lathe and Drill Chucks
Sole Distributor Casler Offset Boring Heads

downward thrust could, of course, be readily taken care of by applying a flat plate which could be formed as a part of the locater itself, but the upward thrust presented a different problem.

The attachment as finally developed consists of a simple holding fixture, as shown in the illustration. The fixture checks the upward thrust, while the downward thrust is taken care of by the previously-mentioned locater plate. The attachment has been thoroughly tried out and has proven satisfactory.

Westcott 2-Jaw Drill Chuck

Simplified construction is the feature of the "Little Giant" two-jaw drill chuck which has been announced by the Westcott Chuck Co., 124 East Walnut Street, Oneida, N. Y. The construction



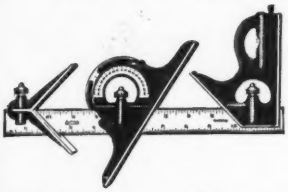
Westcott 2-Jaw Drill Chuck

of the chuck embodies features that are common to the "Improved," "Double Grip," and "Auxiliary Screw" drill chucks manufactured by this firm. The jaws are of steel, tempered and accurately fitted to the body, and guided by three strong gibs. The screws are of special alloy steel and are claimed to be unusually large and strong.

The plate on the face of the chuck prevents the use of larger drills than the chuck is designed to take, and also adds to the strength of the body. The hole in the hub is tapered to take an arbor, but it can be bored and threaded at small expense to fit a template of the spindle on which it is to be used. The chucks are sized by numbers, as follows: 8, 12, 16, 24 and 32. The capacities are 0 to ¼ in., 0 to ⅜ in., 0 to ½ in., 0 to ¾ in., and 0 to 1 in., respectively.

LUFKIN

TOOLS



Micrometers, Calipers, Combination Sets, and Gauges of many kinds. Exclusive features and unexcelled accuracy characterize these tools.

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SMALL TOOL DIVISION

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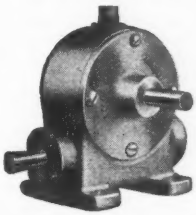
Speed Reducers

1/16 to 5 H.P. Capacity. Ratios of reduction 5-1 to 2500-1



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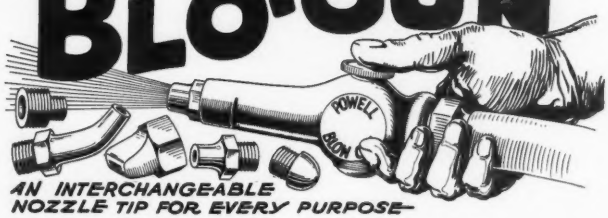
Blow your Turnings or Borings away

BLO-GUN



AN INTERCHANGEABLE NOZZLE TIP FOR EVERY PURPOSE—

POWELL VALVES

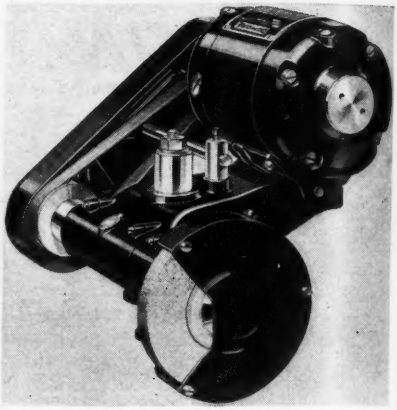
THE WM. POWELL CO., Cincinnati, Ohio

Dumore No. 7 Portable Grinder

The line of high speed portable precision grinders built by The Dumore Company, 28 Sixteenth Street, Racine, Wis., has been augmented by the addition of a larger tool to handle heavier grinding operations than have been possible with the lighter tools. The new grinder, which is known as the No. 7, is essentially a production tool, intended for the heavier grinding operations involved in production work as well as in toolroom grinding.

The motor is pivotally mounted on a rigid cast iron frame. A spring tension between the motor and the frame provides an automatic take-up for the belt, assuring proper tension on the belt at all times. This construction eliminates belt slippage as well as excessive pressure on the bearings. A special locking device provides for maintaining the proper belt tension by counteracting the weight of the motor when the grinder is used in a perpendicular position. An endless hand woven fabric belt, 1 in. wide, transmits power from the motor to the quill. The motor runs at a speed of approximately 12,000 r.p.m., developing up to ¾ h.p.

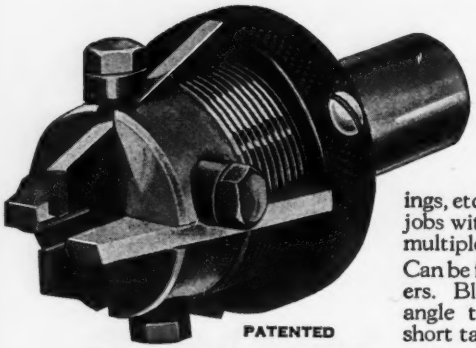
The grinder is provided with two quills, one for external grinding, and one for internal. The quills are of sturdy construction, the outside diameter being 2 inches. The external quill has a reach of 3½ in. from the inside face of the wheel to the frame of the grinder, and operates at speeds of from 4,000 to 10,000 r.p.m. The internal quill has a reach of 2 in. from the inside face



Dumore No. 7 Portable Grinder.

Genesee Adjustable Hollow Mill

Made in 7 different styles



PATENTED

Has adjustable, replaceable blades and can be replaced at nominal cost, making it unnecessary to continually buy new tools.

The ideal tool for finishing your forgings, castings, etc. Do your several operation jobs with Genesee inserted blades multiple operation tools.

Can be fitted with drills and reamers. Blades can be ground any angle to point work and turn short tapers.

A Genesee Adjustable Hollow Mill can be made for every job

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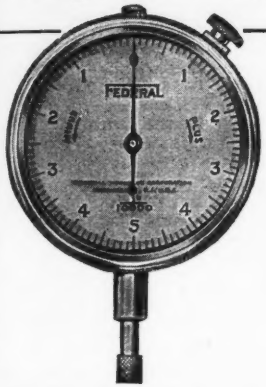
ROCHESTER, NEW YORK

Exclusively a

FEDERAL

Improvement!



DIAL GAUGE inspection is more accurate and faster than any other gauging method — but, the ordinary type of dial gauge cannot "stand the gaff" of all-day inspection on a production basis.

The FEDERAL "Millionwear," however, is the ideal gauge for this service. New type gears and pinions—a FEDERAL improvement—are used in this gauge to maintain its accuracy over a long period of time.

One well-known manufacturer of automobile parts has had a "Millionwear" in constant use every day for more than six months—and it's still operating perfectly.

Send for a bulletin—it describes a test which proves CONCLUSIVELY the value of the FEDERAL "Millionwear" gauge!

Federal Products Corp.

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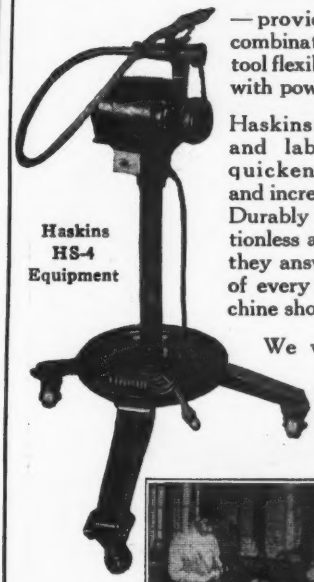
HASKINS

Flexible Shaft Equipment



Haskins HS-4 Equipment

— provide an ideal combination — hand-tool flexibility coupled with power.

Haskins saves time and labor, thereby quickening output and increasing profits. Durably built, vibrationless and efficient, they answer the need of every modern machine shop.

We welcome the opportunity of telling you more.

Die Grinding with Haskins HS-4 Equipment

Write for descriptive catalog on the entire Haskins Line.

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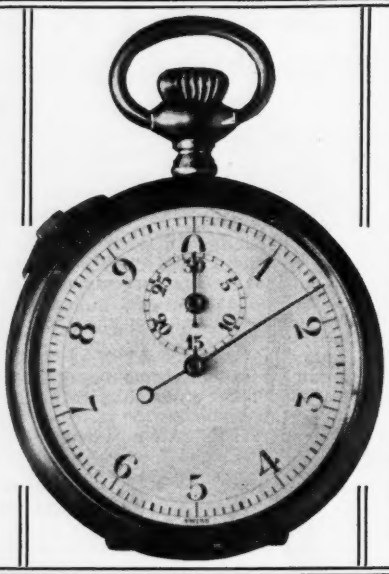


TIME IS MONEY

Accurate time and task standards definitely established through time studies of operation tasks made with Hough Precision Time Study Equipment result in increased efficiency and economies that quickly repay the costs of the survey and equipment. Write for catalog H100 and particulars on how this precision equipment may be applied to your production and wage problems.

HOUGH TIME STUDY WATCHES

AND PRECISION TIME STUDY DEVICES

THOMAS R. HOUGH ASSOCIATES

Industrial Engineers

5337 Belle Plaine Ave. Chicago

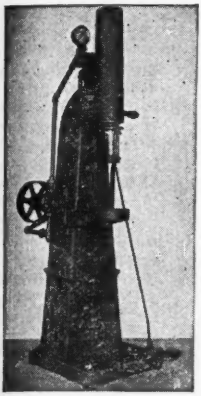
of the wheel to the quill housing, running at speeds of from 10,000 to 27,000 r.p.m. On intermittent work, however, speeds up to 40,000 r.p.m. may be obtained. The quill is held rigidly in position by a quill bracket which is an integral part of the frame. The quill clamp-screws are located so that there is no strain on the bearing and no distortion takes place when the quill clamp screws are tightened. The grinding spindles are of vanadium steel, hardened and ground, and are mounted in open-type or "magneto" bearings which are provided with an automatic take-up. The bearings are held in special steel inserts, cast in the motor housing, and are ground in place so as to insure positive alignment.

The grinder is mounted on a special toolpost which permits both radial and vertical adjustment of the tool. The toolpost is removable and can be mounted in a lathe, planer, shaper, milling machine, or other machine separate from the grinder; it is then a simple matter to place the grinder in position on the post. A locknut in convenient position is provided to lock the grinder in place after setting in position. An additional feature of the grinder is the fact that the motor and quill may be turned end for end, which permits grinding on either end and makes it possible to mount the grinder on the back of the machine. To reverse the motor it is only necessary to remove the pivot pin which holds the motor bracket, turn it end for end, and replace the pin.

Positive lubrication is assured to the motor shaft by two felt oilers with wick feed to the bearings. Bearing housings are constructed practically oil-tight, permitting the grinder to be operated in a perpendicular position without loss of oil from the bearings. Lubrication of spindle bearings is an important feature of the tool. The entire length of the spindle housing is lined with a felt sleeve, thoroughly saturated with oil. Feeders convey the oil from the felt sleeve to an oil slinger on the grinding spindle and centrifugal force carries the oil from the slinger to the bearings in the form of a vapor or fog, so that the bearings may be said to operate continuously in a fog of oil. The felt sleeve also acts as a filter, keeping emery dust from getting to the bearings.

A belt guard is provided which is adjustable to accommodate the various pulley combinations. The wheel is also guarded, as shown in the illustration. The weight of the grinder does not exceed 45 pounds.

BROACH *for Accuracy—Economy!*



Let us show you how to finish more holes—more accurately—and at less cost.

The American 2-Ton Hydraulic Press

is recommended for broaching connecting rods and work that comes within the 2-ton range. We manufacture presses from 2 tons to 150 tons pressure, also all types of broaching tools.

AMERICAN BROACH & MACHINE CO.
ANN ARBOR, MICHIGAN

As a SHAPER —or— As a SLOTTER

USED either way, you can't beat the RHODES "Convertible" Shaper and Slotter when it comes to accuracy, speed and economy!

This tool provides an ideal means of handling a wide range of work ordinarily assigned to larger machines. Easily and quickly changed from one tool to the other it is a space saver in any shop. Send for a Bulletin.

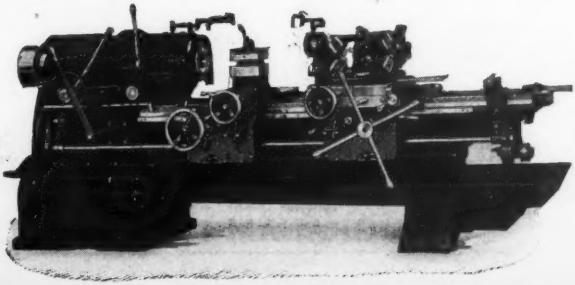
THE RHODES MFG. CO.
WALTHAM MASS.

You'll Get....

...Increased Production...Simplified Operation...Big Machine Rigidity...Small Machine Ease of Control... and Flexibility...in the CINCINNATI ACME UNIVERSAL TURRET LATHE. Send for a New Bulletin!

The Acme Machine Tool Co., Cincinnati, O.

No. 1 or No. 2



Semi or Full Universal

Improvements in "Feed-Matic" Hoppers

Improvements in the design of Feed-Matic Thru-Feed and In-Feed Hoppers for automatically feeding work to Cincinnati Centerless Grinders are being announced by Cincinnati Grinders Incorporated, Cincinnati, Ohio. By using these hoppers in conjunction with centerless grinders, manual feeding operations are eliminated and in cases where the hoppers are operated to feed a battery of machines, a substantial reduction in labor is possible since one operator runs a series of three or four machines.

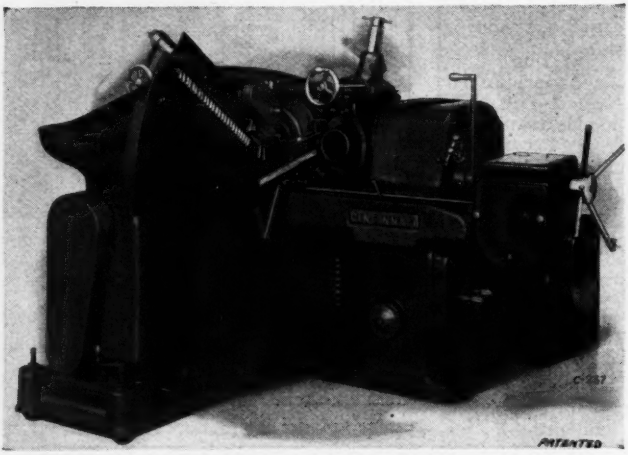


Fig. 1—Feed-matic in-feed hopper set up for automatically feeding headed or shouldered work.

One of the major improvements is embodied in the low work basin so that the dumping of work into hoppers is easier for the operator. These new hoppers are individually motor driven, easily removable from the centerless grinder, quickly adjustable for different sizes of work, and the mechanical arrangement is such that jamming of work or injury to mechanism is eliminated.

Hoppers are mounted on adjustable wheels so that unit can be moved from the grinder in any desired direction. Anti-friction bearings are used, wearing parts are hardened steel, and ample lubrication facilities are provided.

In Figure 1 is illustrated the Feed-Matic In-Feed Hopper set up for automatically feeding headed or shouldered work to the Cincinnati No. 2 Centerless Grinder. Work up to 8 in. under head, head diameter up to 2 in., with ground diameter up to 1½ in., is handled. This hopper is powered by individual enclosed ½ h. p. motor with push button control. This motor drives a pick-up plate which travels in a vertical segmental arc movement in the work basin, which contains the parts to be ground. On each arc movement of the plate, work is selected with shoulder end up. Pieces slide down a receiving chute and are placed in position on the work support blade between the wheels for grinding. The hopper keeps the chute constantly supplied with work and grinding is done with all possible idle time eliminated.

The ejector rod on the automatic in-

For DRILLER MILLER, SHAPER OR PLANER

VISE

THREE SIZES
Jaws 6", 9" and 12" Long

Fig. 2. Without Jig Attachments

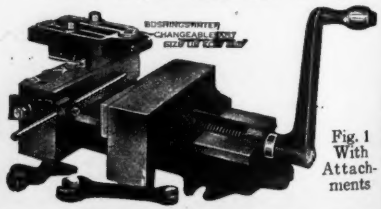


Fig. 1 With Attachments

THE GRAHAM MFG. CO., 69 Willard Ave. Providence, R.I.

98% plus...

...is the total amount of motor power delivered by the herringbone Gear Drive of the Mitchell polishing machine to the polishing wheels. Less than 2 per cent of the power is wasted.

In addition to this feature, the Herringbone Gear Drive allows you to obtain any speed from 1800 to 3000 R.P.M. regardless of the speed of the motor, and you still get all the benefits of a direct motor drive.

There are many more advantages obtainable with this machine . . . let us show you. Just write for a bulletin.

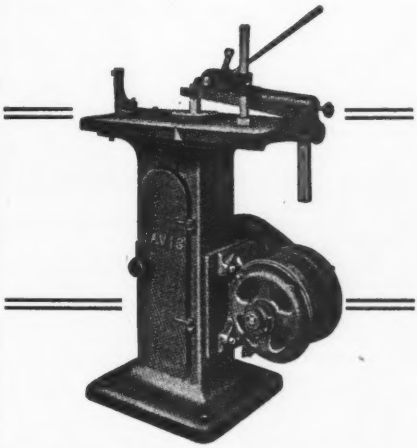
Model 17 MITCHELL MOTOR Driven Polishing Lathe with herringbone gear drive.

The MITCHELL Engineering Co.

SPRINGFIELD, OHIO

Winning...

Where Other Methods Fail!



KEYSEATING on a milling machine or some other large shop tool is costly . . . costly, due to its slow, complicated set-up.

But that's where the Davis Keyseater wins out. TWO MINUTES is all that is required to set up this tool for any job from $\frac{1}{16}$" to 1" wide and 12" high. It cuts tapered or straight keyways with equal efficiency.

Get the whole story of DAVIS Two-Minute Set-Up . . . it means maximum production at lower costs! Send the coupon.

Davis Keyseater Co.

250 MILL ST. ROCHESTER, N. Y.

Send me the whole story of the Davis Keyseater and the Two-Minute Set-Up.

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feed attachment controls the timing of the hopper. Thus the same cycle which controls the in-feed also controls the selection of pieces by the hopper. An essential part of the equipment is the Cincinnati Automatic In - Feed Attachment, which cuts the idle time between grinding cuts down to a minimum. In conjunction with the in-feed hopper, a suitable in-feed work rest with automatic ejector is used.

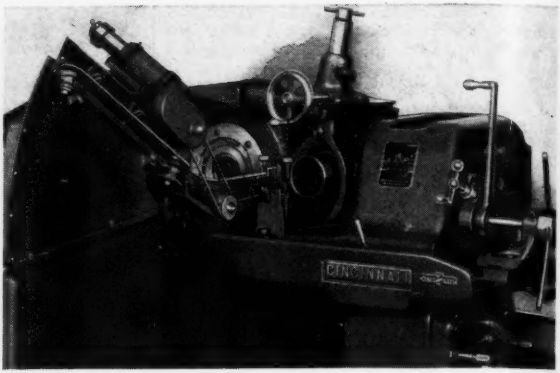
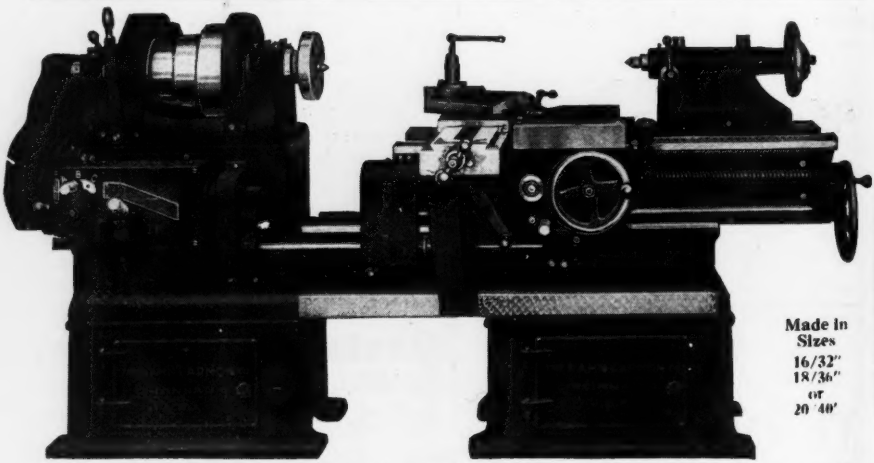


Fig. 2—Feed-matic thru-feed hopper arranged for automatically feeding straight cylindrical work.

The Feed - Matic Thru-Feed Hopper arranged for automatically feeding straight cylindrical work to a Cincinnati No. 2 Centerless Grinder is shown in Figure 2. This hopper is identical in construction to the In-Feed type illustrated in Figure 1, except that it does not have the arrangement for automatic in-feeding. Substituted for this mechanism is the gravity chute down which slide the straight cylindrical parts onto the work support blade. This Feed - Matic Thru - Feed Hopper takes work ⅛ in. to 1½ in. in diameter up to 8 in. long and minimum length exceeding the diameter.

An adjustable tie rod keeps the hopper in proper position relative to the grinder. To compensate for wheel wear and to keep hopper in alignment for accurate feeding, a cross adjustment is provided. If desired, additional parts may be obtained so that In-Feed Hopper can quickly be converted to a Thru-Feed Hopper.



Made in Sizes 16/32" 18/36" or 20/40"

Rahn-Larmon 18/36" Extension Bed Gap Lathe

A lathe for large or small swing work, ready at all times. Requires no extra rigging up. Takes different distances between centers.

Belt driven or with nine speed all geared motor driven head. Tell us what your requirements are and let us quote you.

THE RAHN-LARMON CO. 2935 Spring Grove Ave., Cincinnati, Ohio

FOR YOUR **RIVETING**

LINLEY Rotary Rivet Spinners—assure peak production and lower Maintenance costs. Cover a wide range of riveting. Rigidly built and powerful. Made in 15 models.

Send samples of your work for riveting, cost of equipment, and true estimates on production.

"They Rivet Noiselessly"

LINLEY BROTHERS CO.
BRIDGEPORT, CONN.

Drill Bolster Plates
WITH A
Koza Right Angle Drill

WHEN you drill holes for die sets in bolster plates—instead of using an "old man" and hand ratchet feed—hook up a Koza Right Angle Drill to your air or electric drill and put the hole in by power. Save time!

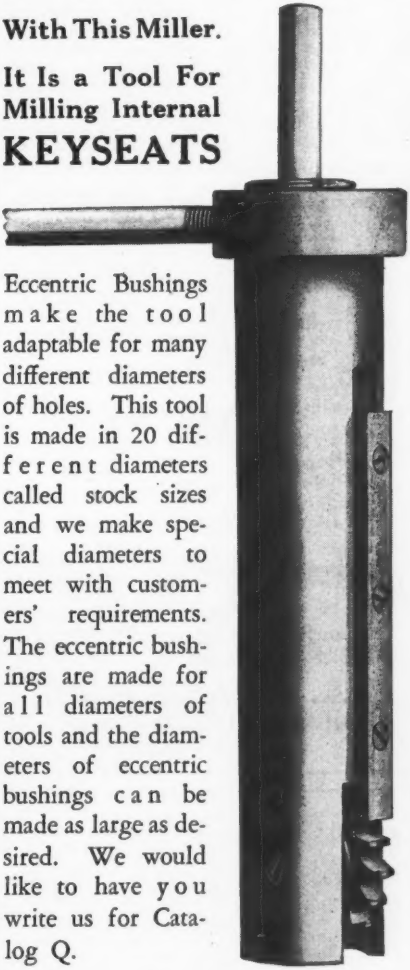
Koza Right Angle Drills and Grinders also save tearing down a machine on repair work. Every maintenance and repair department should have one to reach the broken bolt or part, by drilling around the corner—at right angles.

These tools are used for grinding, drilling, keywaying or countersinking. There is a tool for every requirement—in every industry.

WRITE FOR BULLETIN

CHAS. A. KOZA
464 AUGUSTINE STREET
ROCHESTER, N.Y.

Numerous Sizes of Holes Can Be
KEYSEATED
With This Miller.
It Is a Tool For Milling Internal KEYSEATS

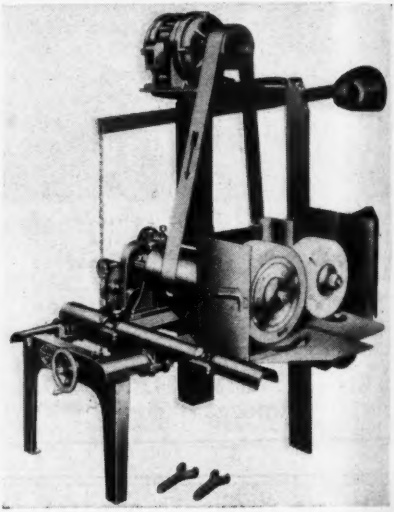


Eccentric Bushings make the tool adaptable for many different diameters of holes. This tool is made in 20 different diameters called stock sizes and we make special diameters to meet with customers' requirements. The eccentric bushings are made for all diameters of tools and the diameters of eccentric bushings can be made as large as desired. We would like to have you write us for Catalog Q.

National Machine Tool Co.
2271 Spring Grove Avenue
CINCINNATI, OHIO, U. S. A.

Excelsior No. 97 Polishing Wheel Surface Truing Machine

The illustration shows the Excelsior No. 97 Polishing Wheel Surface Truing Machine, which has been placed on the market by the Excelsior Tool and Machine Co., East St. Louis, Ill. It is said that the use of this machine for truing polishing wheels will make it possible to maintain quality as well as production and reduce wheel maintenance costs. The machine consists primarily of two spindles upon which the wheel to be dressed and the grinding wheel with which the truing is done are mounted. The spindles revolve in opposite directions, driven by an endless belt powered by a 7½ h. p. motor. The motor is mounted upon a hinged platform which is counterbalanced by a weight to maintain the proper belt tension, as shown. The polishing wheel spindle has a side oscillation movement of 2 inches in order to maintain true surfaces on both the polishing and grinding wheels, and is easily disengaged for truing irregular-surface wheels. It is said that the finest felt, fabric, leather, or buff wheels can be trued to any shape by the use of a straight or master-shape abrasive cutting wheel without burning or injuring the fabric in any way. The dust hood is of rigid sheet metal construction with



Excelsior No. 97 Polishing Wheel Truing Machine

⅓ H. P.
Type M5-A

Strand

Full Ball Bearing Machine

⅓ H. P.

Absolutely the finest machine built

—

We build sixty types and sizes of flexible shaft machines

—

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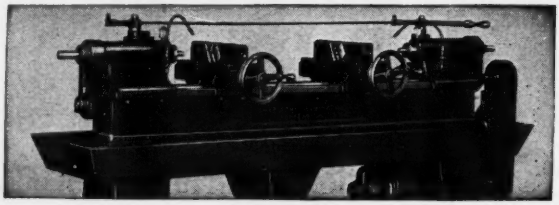
N. A. STRAND & CO.

5001 NORTH LINCOLN STREET
CHICAGO, ILLINOIS



Sundstrand

Double End Centering Machine

For centering both ends of a shaft simultaneously. Spindles operate together or independently. L. H. head is removable for long shafts. Accommodates a wide variety of work. Special fixtures furnished when desired. Send for Bulletin.

SUNDSTRAND MACHINE TOOL CO. **Rockford, Illinois**

SAVES THE WAGES OF 25 MEN

AN automobile body manufacturer uses eight OLIVER Die Making Machines for filing automobile doors—*and saves the wages of 25 men.* On practically any sawing, filing or lapping operation, an OLIVER saves its modest cost many times in a year.

Send for illustrated bulletin today.

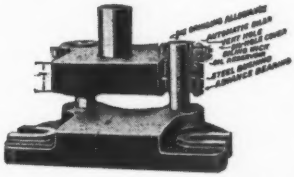
OLIVER OF ADRIAN

THE OLIVER INSTRUMENT CO.
1430 Maumee Street, Adrian, Mich.

BAUMBACH

Automatically Oiled

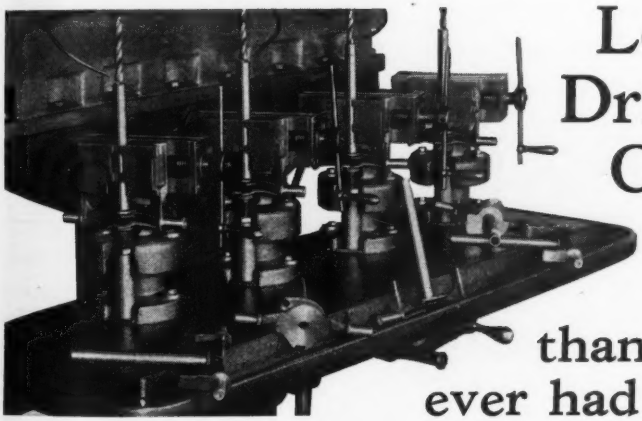
DIE SETS



Standardized die sets, embodying many exclusive features, and a listing of 70,000 stock sizes afford a service that is unsurpassed.

Your Inquiries Solicited
Send for New 120 Page Catalog

E. A. Baumbach Mfg. Co.
1806 S. Kilbourne Ave. Chicago, Ill.



Lower Drill-Jig Costs

than You ever had before!

LOWER Drill Jig and production costs are two of the big savings you get with "JOHN'S" Universal Drill Jig.

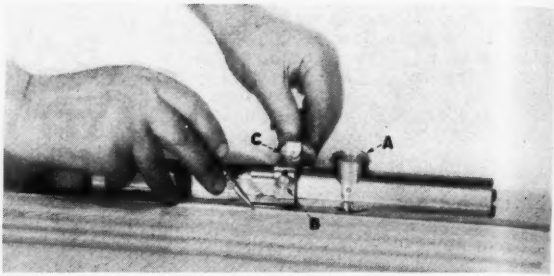
For instance, the job shown in the illustration . . . drilling a ⅝-in. hole through 11 inches of forged steel . . . was formerly done on a hand screw machine. Now this manufacturer uses "JOHN'S" Universal Drill Jig and saves two-thirds of his old costs, besides increasing the accuracy of his work.

Investigate these possibilities in your shop . . . send for bulletins or mail us your blue-prints for prices on special jaws.

Heuser Manufacturing Co. 1638 N. PAULINA STREET CHICAGO, ILLINOIS

hinged doors. The top is provided with a 10 x 10-in. sliding non-breakable glass cover through which the truing process can be observed.

The standard machine will take up to 16 in. dia. by 6 in. face wheels. Shaft diameter for wheel ends, 1½ in. Abrasive wheel 14 x 4 to 5-in. face. Height of machine, 7 ft. Floor space, 6 x 6 ft. Weight, 2,300 pounds.



Alpha Micrometer Rolling Parallel Ruler

Alpha Micrometer Rolling Parallel Ruler

Engineers and draftsmen will appreciate the advantages of the rolling parallel ruler which has been placed on the market by the Alpha Instrument Company, 2103 K Street, N. W., Washington, D. C. The ruler is provided with rollers by which it is practically "geared to the paper," the amount of travel up or down being indicated by the rotation of a micrometer dial. The dial is controlled by the rollers through a worm gear and

Bottom side of ruler showing rollers

There Is a NIELSEN LIVE CENTER For Your Work!

No matter what kind of work you have—turning or grinding—high or low speeds—light or heavy loads—a NIELSEN LIVE CENTER will give you years of dependable service.

These centers have the required stamina to stand up under the gruelling high speeds necessary when using tungsten carbide tools.

It will pay you to investigate the NIELSEN CENTER.

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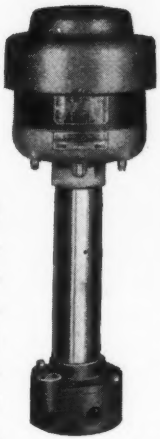
NIELSEN, INC., LAWTON, MICHIGAN

Foreign Representative: Gaston E. Marbaix, Ltd., Adelaide House, King William St., London, E.C.4

THE
Efficiency Expert
in your shop!



Unpaid — almost unnoticed—this little "expert" is accomplishing in hundreds of shops what no high salaried efficiency man can . . . it is putting production on a faster scale . . . it is helping to do more work per minute—better work at lower cost—and it isn't decreasing employment! Good times or bad, you will find GUSHER a valuable addition to your shop equipment. Write for catalogue and information.

GUSHER COOLANT PUMP

THE RUTHMAN MACHINERY CO.

532 East Front St.
Cincinnati, Ohio

NOW PARTS CAN BE STACKED AND STILL BE ACCESSIBLE!

THE new Simplex Nesting Bin can be stacked several high, and unlike boxes, contents are easy to get at. Parts in bins are also easy to find because they are visible.

Bins nest deeply into one another. No amount of vibration will unstack them. They must be lifted out of each other.

Ideal for assembly, and destined to make old assembly methods obsolete. Place many parts within easy reach of assembler.

Make weighing practical for inventory purposes. Provide an expanding and contracting stockroom.

Made in four standard sizes.

Bin No.	Width	Height	Length
1	5½ in.	4 in.	12 in
2	7½ in.	5¼ in.	15 in.
3	9 in.	6½ in.	18¼ in.
4	12 in.	9½ in.	20 in.

Special sizes furnished to meet individual requirements.

SIMPLEX TOOL CO.
WOONSOCKET RHODE ISLAND

SIMPLEX TOOL CO.,
Woonsocket, R. I.

Kindly send descriptive circular and quote prices on Simplex Nesting Bins.

Name.....

Title.....

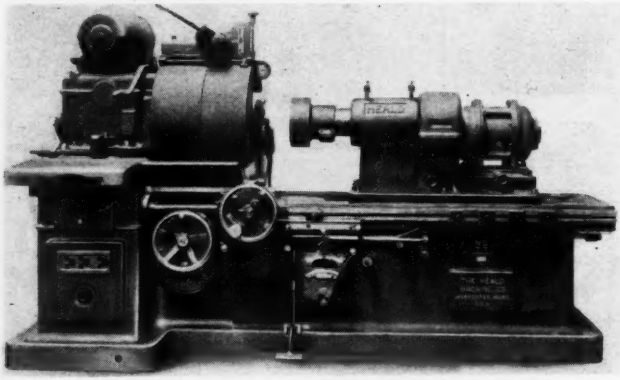
Firm.....

Address.....

shaft. In the illustration, the dial is indicated at **A**, **B** and **C** indicate the ends of the worm gear, with a dial at **C** for reading small or micrometer spacing. By raising the end of the worm shaft **B**, the worm is disengaged and the ruler may be moved freely. By pressing down on **B**, the worm is engaged. With ordinary care in spacing, lines can be spaced within .001 inch. The ruler is particularly adapted for use in logarithmic or trigonometric spacing and for section lining and shading.

Heald No. 77 H. D. Internal Grinding Machine

Designed primarily for the rapid removal of large amounts of stock with fine finish and close accuracy on large work, the Heald No. 77 Heavy Duty Internal Grinding Machine — the largest internal chucking machine built thus far —fills a definite need in the grinding field. The machine is intended for use in hogging out metal from large gears, bearing races, rolls, pipes, sheaves, and so on, and then finishing the work to close limits. It will grind either straight or taper bores with equal facility and will face-grind without changing the set-up.



Heald No. 77 H. D. Internal Grinding Machine

The machine is self-contained, of unit design with each unit readily accessible. Power is supplied by three motors—one for the wheelhead, one for rotating the work, and one for driving the hydraulic system. Hydraulic operation of the table, ample power, centralized control, massive construction, sizing control unit, and hydraulically-operated wheel truing device are outstanding features.

The base is a four-ton one-piece box-type casting, heavily ribbed. Well-proportioned ways, one V and one flat, support the table. The main table, weighing over a ton, is driven by the Heald hydraulic arrangement which is operated by oil under constant pressure, providing complete control of table speeds and direction of movement at all times. The hydraulic system mechanism is easily accessible. The pump is a gear-type unit built by Heald for high pressure duty. It is equipped with anti-friction bearings and is driven by a 3 h. p. motor.

Automatic reversal of the table is controlled by three adjustable dogs, two of which are set for reversal of the table, providing for any length movement up to a maximum of 36 in. The third allows the table to withdraw sufficiently so that the wheel can pass the diamond during the trueing operation, or so that the work may be measured.

The unusual design of the wheelhead unit assures absolute rigidity of the spindle and maximum delivery of power to the wheel, both of which are necessary in hogging off stock. The wheelhead and driving motor form a single unit, as the spindle bracket, motor platform, and lower half of the belt guard are cast in one piece. The spindle is mounted in two precision-type anti-friction bearings carried in a cradle that is cast integral with the spindle bracket. The 25 h. p. motor can be adjusted to compensate for stretch of the 7-in. driving belt. Correct tension of the belt is maintained by an adjustable spring idler.

The workhead, which is of extra heavy construction, is securely clamped in position on a cross slide at the T-end of the machine. The head can be swivelled, an adjustment of 22½ deg. being provided, with adjustment indicated on a graduated scale.

The workhead spindle is mounted on two large anti-friction bearings and is driven by a hardened and ground worm and bronze worm gear running in oil. The worm is driven by a 3 h. p. motor through a double disc clutch which is

Multiple Units

From Single Drills

Designed to fit any type of drill press, a U. S. Drill Head converts any single spindle drill into a multiple unit quickly.

No time wasted making adjustments—spindles are fixed. Any number of holes, fifty if necessary, can be drilled as easily as one.

We will design a U. S. Multiple Drill Head to meet your individual requirements. Tell us your needs. Address

The United States Drill Head Co.

1954 Riverside Drive

Cincinnati, O., U. S. A.

3 Siewek Tools

SERVING INDUSTRY WELL

To serve industry well, a tool must save time...energy ...or money. Siewek Tools make these savings. Take for instance:

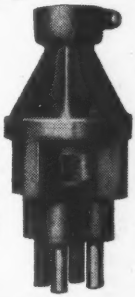
Siewek Drill Jigs

The cushion clamping of these jigs saves energy, loading time, allows closer accuracy, and increases production. They are built in nine sizes.

Siewek Fixture Locks

These locks ave production costs by reducing spoiled work. The quick, positive action insures a strong grip that holds work immovable, eliminating danger of shifting under cut. There are nine sizes.

Siewek Drill Heads



When used with Siewek Drill Jigs, these heads insure a set-up that will save time and increase production. There is a Siewek Drill head for every need.

WRITE FOR A CATALOG

Siewek Tool Co.

10232 Woodward Ave., Detroit, Mich.

controlled by a hand lever. Spindle speeds varying from 35 to 140 r.p.m. are available through the adjustable speed motor.

The feeding principle of the No. 77 machine is unique in that the work is fed to the wheel instead of the wheel being fed to the work. This is accomplished by mounting the workhead on a substantial cross slide carriage which slides in dovetailed ways on the bridge at the T end of the base. Any amount of feed from .00014 to .0011 in. per stroke of table may be obtained with power, or the feed may be controlled by hand if desired. A coarse feed for the wheel can be set for rough grinding to a predetermined limit at which point the feed automatically changes to a fine finishing feed. The swinging diamond wheel truing device swings on a ball bearing, is hydraulically operated, and is easily adjusted.

The largest bore that can be ground, using a 12-in. wheel, is 21 in. diameter. Greatest length of bore, 15 in.; swing over table, 35 in. dia.; swing inside water guard, 21 in.; hole through spindle, 1⅞ in.; maximum travel of table, 36 in.; floor space, 123 x 78 in. Workhead speeds, 35 to 140 r.p.m. Table speeds, 0 to 25 ft. per min. Net weight, 18,000 pounds.

Fire Preventatives

(Continued from page 44)

with an adequate supply. However, it is possible to make a very effective fire-fighting material by combining sawdust with sulphate of alumina or alum in the proportions of 20 pounds of sulphate to a bulk which forms about 80 per cent of sawdust. This proportion is equivalent to approximately seven pounds of chemical to a cubic foot of sawdust. Sawdust from oak or beech has been found to give the best results.

A mixture of the materials named can easily be stored in sheet metal boxes at various points about the shop where it will be immediately available in case of fire. The mixture should be scattered over the fire in a heavy layer, so as to choke the fire by cutting off the air supply. The boxes should be marked "For Extinguishing Oil Fires."

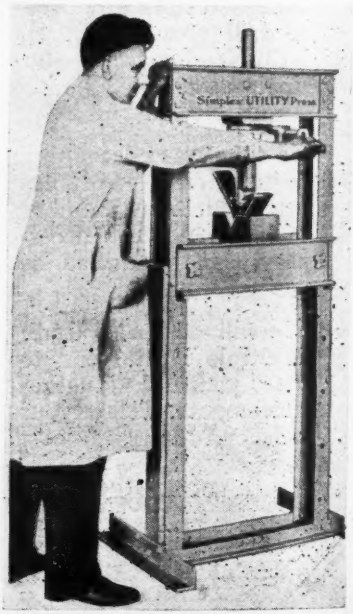
NOW SUFFICIENT PRESSURE AT LOW COST!

Pressures up to 80,000 lbs. can be exerted in the new Simplex Utility Press designed for toolroom and machine shop use. Has three different leverages.

Makes easy work of all straightening, bending and forcing jobs, and time saved will quickly pay the low cost of press.

Novel V Blocks make it combination Straightening, Forcing and Arbor Press. Separated, these blocks serve as straightening V's; placed together, as a V Die into which V nose fits; and laid flat, as a table with square hole in center.

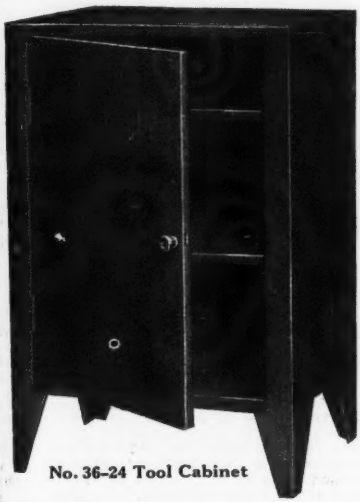
Made in 21" and 33" sizes.



SIMPLEX TOOL CO.
WOONSOCKET RHODE ISLAND

SIMPLEX TOOL CO., WOONSOCKET, R. I.
Kindly send bulletin showing what the 80,000 pounds pressure of the Simplex Utility Press will do for me.

Name.....Title.....
Firm.....
Address.....

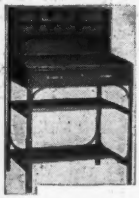


No. 36-24 Tool Cabinet

Buy For Tomorrow As Well As Today!

WHEN you buy Angle Steel and Sheet Metal Equipment, you are insuring outstanding production records for many years to come.

No. 36-24 Tool Cabinet. Built of heavy sheet steel. Size 36" high, 24" wide, and 16" deep. Two loose shelves. Adjustable. Olive green enamel finish. Locking knob handle, keys furnished.



No. 38 Foreman's Desk

No. 38 Desk. Adjusts from 37½" to 46½" in front. Two adjustable and removable shelves. Large steel drawer, lock equipped. Top has various sized compartments. Width 34", depth 28". Olive green lacquer finish.

No. 218 DC Machine Tender

No. 218 DC Machine Tender. Extremely well built and rigidly braced. Lock-equipped drawer for tools, dies and parts. Two-inch swivel casters. All joints hand riveted. Size 24" x 18" and 35" high.

Write for Catalog "C-MMS" to

Angle Steel Stool Co.

"The Steel Equipment People"

PLAINWELL -:- -:- MICHIGAN

Eclipse HIGH PRODUCTION TOOLS

The Interchangeable Center

This is No. 5 of a series of advertisements describing the ECLIPSE Line of High Production tools. Watch for others to follow.

The outstanding feature of the Eclipse Interchangeable Center is the economical replacement of only that part of the tool which receives the most wear—the point.

This center — besides having a high speed steel insert—is adjustable. The point of the insert may be reground for the major portion of its length and when finally worn out — being interchangeable — a new insert may be quickly installed.

This quick and economical replacement of the point pays for the center in a very short time. Send the coupon for bulletin.

ECLIPSE COUNTERBORE CO.
DETROIT MICH.

ECLIPSE COUNTERBORE CO.
Detroit, Michigan.
Send me a bulletin on the ECLIPSE Interchangeable Center.

Name .....
Firm .....
Address .....
City ..... State .....

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Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than ten.

Abrasive Grinding Wheels: The types of wheels, with recommended grades and grains, which should be used for each of the various kinds of grinds are discussed in a booklet which will be sent free to mechanical executives by the Abrasive Company, Philadelphia, Pa.

Broaching By Modern Methods: Equipment and tools for finishing round, square or irregular-shaped holes and surfaces by broaching are described and illustrated in a booklet that is issued free by the American Broach & Machine Co., Ann Arbor, Michigan.

Ames Dial Gages: The latest types of dial gages for inspection purposes are described in the Ames No. 55 Bulletin, which will be sent free to any machine shop executive. Address B. C. Ames Co., Waltham, Mass.

Scraping By Power: Bearing surfaces can now be scraped with a power scraper that is quicker and easier than the old-fashioned hand method. The tool is described in a folder that is issued by Anderson Bros. Mfg. Co., 1926 Kishwaukee St., Rockford, Ill. Sent free on request.

Steel Furniture for the Shop: The complete line of steel furniture made by the Angle Steel Stool Co., Plainwell, Michigan, including steel stools and chairs, steel foremen's desks, lockers, tables, tool stands, machine tenders, shop boxes and pans, iron bar racks, trucks, bench legs, and bench drawers, is described and illustrated in Catalog "C," which is issued free to machine shop executives.

Stop Tap Breakage: A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by The Apex Machine Co., 200 Davis Ave., Dayton, Ohio. Sent free upon request.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

Metal and Wood Saws: Catalog No. 20 describing saws of all kinds, for both metal and wood. 256 pages of descriptions of saws and sawing machinery. E. C. Atkins & Co., 402 S. Illinois St., Indianapolis, Ind.

Hold Odd-Shaped Pieces Securely: A vise in which odd-shaped work can be held securely without the need of special jaws or fixtures is described in a folder that has been issued by The Avey Drilling Machine Co., P. O. Box 487, Cincinnati, Ohio. Copy free upon request.

Hobs and Milling Cutters: A complete line of milling cutters and hobs for cutting all kinds of gears, splines, sprockets and other forms is described in Catalog G, issued by the Barber-Colman Company, Rockford, Ill. Descriptions and illustrations of the Barber-Colman hobbing machine and hob-sharpening machines are included. Sent free on request.

All-Geared Drilling and Tapping Machines: A catalog describing in detail the various types of all-geared, self-oiling, drilling and tapping machines made by the Barnes Drill Co., 801-851 Chestnut Street, Rockford, Ill., will be sent free upon request.

Modern Drilling Equipment: Circulars describing the various types and sizes of Barnes upright drills, multiple drills and horizontal drilling machines made by this company have been issued by the W. F. & John Barnes Co., Rockford, Ill.

Automatic Oiled Die Sets: The automatic oiled die sets, die shoes, punch holders, leader pins, bolster plates, bushings, and other standard die parts made by the E. A. Baumbach Manfg. Co., 1806 S. Kilbourn Ave., Chicago, Ill., are described in Catalog No. 5, which has been issued by that company. Sent free upon request.

Boker Keyless Chuck: A chuck that is built of three units, grips like a vise, and needs no key is described in a pamphlet that can be obtained by addressing H. Boker Co., Inc., 103 Duane St., New York, N. Y.

"C-V" Chrome Vanadium Wrenches: A complete line of wrenches made of Chrome Vanadium steel—practically unbreakable—is described in a booklet that has been issued by the Bonney Forge & Tool Works, Allentown, Pa. Copy free upon request.

Bradford Precision Lathes: Precision Lathes for the tool room and for general manufacturing purposes, all-geared and cone types, belt or motor driven, are described and illustrated in a catalog that is issued by The Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio. The catalog also includes descriptions of taper, relieving, turret and other lathe attachments. Sent free upon request.

Mark Tools or Parts: Metals are easily marked by the Etchograph—an electrical unit that can be used with any light circuit. For particulars address William Brewster Company, 52 Church St., New York, N. Y.

How To Sharpen Staggered Tooth Cutters, Helical Milling Cutters, and Two-Lipped End Mills: A series of pamphlets on these subjects can be obtained without charge by addressing the Brown & Sharpe Mfg. Co., Providence, R. I.

High Speed Drill Presses: A complete line of drill presses that can be run at high speeds with complete safety is described in catalog number 50, issued by the Canedy-Otto Manufacturing Company, Chicago Heights, Ill. This catalog also contains descriptions of other equipment manufactured by this concern. Sent free upon request.

Grinding the Centerless Way: The advantages of the centerless grinding method is discussed in a booklet which also describes the centerless grinding machines made by Cincinnati Grinders, Inc., Cincinnati, Ohio. The illustrations show various types of jobs in process, and full data is included. Copy free upon request.

Cincinnati Hydromatics With Locked Hydraulic Feed is the title of a book that describes in detail the new type of automatic milling machine with hydraulic feed which has been developed by The Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio. Copy free to any machine shop executive.

Rapid Traverse Planers: Cincinnati Hypro Planers, made by the Cincinnati Planer Co., Cincinnati, Ohio, are described in a new catalog that has been issued by this company.

Bolender Gear Burnishers: Gears will operate more smoothly and more silently if burnished. Full description of the Bolender Gear Burnisher can be had by addressing the City Machine & Tool Works, Third and June Sts., Dayton, Ohio.

Handbook For Drillers: The Cleveland Twist Drill Co., 1242 E. Forty-ninth St., Cleveland, Ohio, has published a book in which the various parts of the twist drill are described, and which tells how to grind a drill correctly. The troubles that result from incorrect grinding are described and illustrated and several chapters are devoted to the subjects of speeds, feeds, materials, cutting compounds, and so on. Sent free upon request.

Columbia Superior Shapers: Bulletin No. 17, issued by The Columbia Machine Tool Co., Hamilton, Ohio, describes and illustrates the line of heavy duty shapers made by this firm. Copy free upon request.

Columbia Tool Steel Handbook: A book containing valuable information concerning the making of tools, heat treating, uses of hardness testing instruments, uses of the quenching bath, drawing bath, and other heat treating equipment, and together with tables and

WHITON LATHE CHUCKS

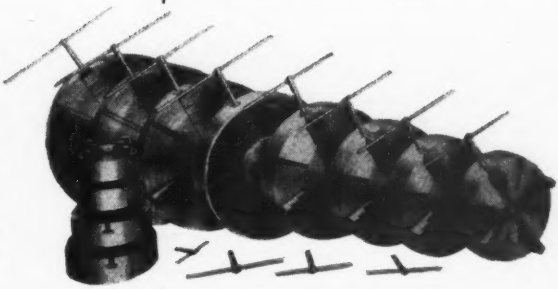
For a Sure Grip!

WHEN work must be held rigidly and securely for accurate machining at top speeds — WHITON Lathe Chucks prove their superiority!

WHITON Chucks—and there's one for every requirement—are good chucks. Their design and workmanship assure you dependable service over a long period of time.

Get a WHITON Catalog—it shows the complete line of WHITON Chucks as well as many special chucks built for special requirements.

Here is a group of WHITON Steel Body Independent Chucks designed to hold heavy work under heavy cuts at high speed. The one-piece body resists sudden strain.



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NEW LONDON CONN.

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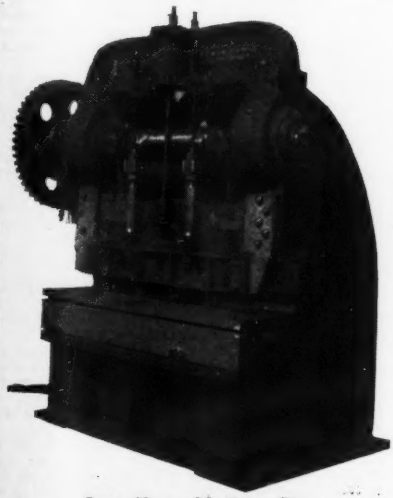

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Both Prime Factors Built in

POWER PUNCHING and SHEARING

Machinery Made By

THE LONG & ALLSTATTER CO.

HAMILTON, OHIO

A superior and more complete line than ever, for perforating and cutting off metal in practically any size or shape

STEEL PRESS BRAKES
ALLIGATOR SHEARS
POWER PRESSES

other useful information can be obtained without charge by addressing the Columbia Tool Steel Co., 550 E. 14th St., Chicago Heights, Ill.

Comtorplugs: Interchangeable plugs for internal gaging, from .250 in. to 8 in. dia. and up to 24 in. in length, graduated by an amplifier to .0001 in., are described and illustrated in a circular that has been issued by The Comtor Company, Waltham, Mass. Copy free upon request.

Table of Hardness Scales giving in parallel columns corresponding figures in Rockwell, Shore and Brinell, with table of size and capacity of broaches made by the Connecticut Broach & Machine Co., New London, Conn., on obverse side, can be had by addressing this company. Particularly useful in heat treat department. Without charge.

Die Makers' Supplies: A complete line of die sets, leader pins, bushings, and other die makers' supplies are described in a book that is issued by the Danly Machine Specialties, Inc., 2104 South 52nd Avenue, Chicago, Ill. Sent free upon request.

Davis Keyseaters: Recent developments in keyseating methods are discussed in a bulletin that also describes the keyseaters made by the Davis Keyseater Company, 250 Mill St., Rochester, N. Y. Copy free upon request.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Surface-Grind the Modern Way: Bulletin 635, issued by the Diamond Machine Co., 17 Codding St., Providence, R. I., tells the advantagees of modern, hydraulically-operated grinders, and describes the Diamond Type G Hydraulic Surface Grinding Machine. Copy free upon request.

Precision Grinding: A booklet which describes and illustrates the most modern methods of performing all kinds of precision grinding operations, showing how the Dumore grinder can be applied to various kinds of machine tools, has been published by The Dumore Company, Racine, Wis. Copy free upon request.

Interchangeable High Production Tools: Catalog No. 28, issued free by the Eclipse Counterbore Co., 7410 St. Aubin St., Detroit, Mich., describes and illustrates the interchangeable counterbores, spot facers, end form cutters, and other end cutting tools made by this firm.

Grooved Cast Iron Pulleys: All sizes of grooved cast iron pulleys, made by Efficient Machine Shop, 147 Baxter St., New York City, are listed in a circular that can be had by writing this firm.

Precision Measuring Instruments: The latest types and models of dial indicators, thread lead test gages, pitch gages, thickness gages, dial comparators, and other precision measuring instruments marketed by the Federal Products Corporation, Providence, R. I., are described and illustrated in a book that will be sent free upon application to this firm.

The Involute Gear Simply Explained: A direct, clear explanation of the theory and principles of involute gearing without the use of higher mathematics can be obtained without charge by addressing The Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

Questions To Ask Before Buying a Jig-Boring Machine: A list of the fine points to look for in a jig-boring machine, with descriptions and illustrations of the working parts of the Swiss Jig Borer, can be obtained free by addressing The R. Y. Ferner Co., 1511 K St., N. W., Washington, D. C.

Formica Silent Composition Gears: A booklet telling about the uses and advantages of Formica Silent Shock Absorbing Gears, and containing a considerable amount of valuable data with rules and tables for laying out, cutting and using gears. Sent free by Formica Insulation Co., 4632 Spring Grove Avenue, Cincinnati, Ohio.

Fosdick Drills: This publication gives details as to the design and construction of Fosdick Radial, Upright, and Sensitive Drills. Published by the Fosdick Machine Tool Co., Cincinnati, Ohio.

Modern Grinding Equipment: The complete line of universal tool and cutter grinders, surface grinders, drill grinders, tap grinders, and other grinding machines made by the Gallmeyer & Livingston Co., 336 Straight St., S. W., Grand Rapids, Michigan, is described in a series of bulletins that have been issued by this firm. Free upon request.

Flat Surface Grinding: Automatic, semi-automatic, and single-purpose machines for performing all kinds of grinding operations on flat surfaces are described and illustrated in a book that has been issued by the Gardner Machine Company, Beloit, Wis. Copy free upon application.

Adjustable Blade Cutters: Hollow mills, facing tools, face mills, milling cutters and other production tools with adjustable, interchangeable blades are described and illustrated in a booklet that is issued free by the Genesee Manufacturing Co., 141 N. Water St., Rochester, N. Y.

Machine Vises of all sizes for use with machine shop equipment are described in a circular that will be sent free upon application to The Graham Mfg. Co., 69 Willard Ave., Providence, R. I.

Greaves-Klusman Lathes: A book containing complete descriptions of the latest types of lathes made by this firm has been issued by the Greaves-Klusman Tool Co., Oakley, Cincinnati, Ohio.

Swiss Files: The complete line of Grobet Swiss Files for use in die and tool work or for other fine work is described and illustrated in Catalog "K," published by the Grobet File Corporation of America, 3 Park Place, New York, N. Y. Copy free upon request.

Drawing Tables: The Hamilton steel-base, adjustable drawing table is described in Catalog No. 7-MS, issued by the Hamilton Mfg. Co., Two Rivers, Wis. Copy free upon request.

Flexible Shaft Equipment Eliminates Hand Labor: Files, drills, grinding wheels, and other tools can be mechanically operated by the use of the flexible shaft equipment manufactured by the R. G. Haskins Co., 4653 W. Fulton St., Chicago, Ill. Catalog free upon request.

Universal Drill Jig: The John's Universal Drill Jig can be used for drilling, centering, milling, reaming, tapping, and other operations with slight changes. Descriptive circular can be had by addressing the Heuer Manufacturing Co., 1638 N. Paulina St., Chicago, Ill.

Texdrive Grinders for Vitrified or High Speed Wheels: A six-page bulletin No. 43 describes in detail and illustrates the advantages of the new Hisey Texdrive Grinder—stressing especially the multi-speed and single-speed machines. Write for a copy to The Hisey-Wolf Machine Co., Colerain and Marshall Sts., Cincinnati, O.

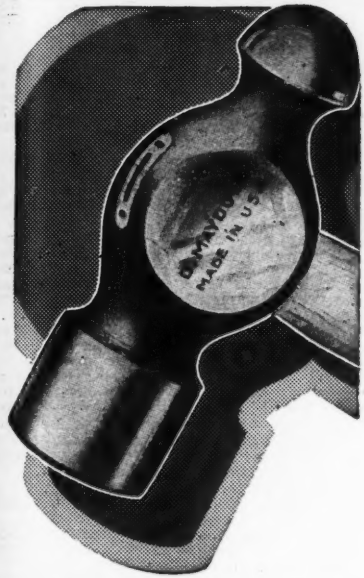
Speed Reducers: A catalog of speed reducers up to 200 h.p. and built to deliver any ratio desired in standard size units can be obtained by addressing The Horsburgh & Scott Co., 5110 Hamilton Ave., Cleveland, Ohio. Give firm name.

Make Time Studies: Full equipment for making time studies, including stop watches, time study observer's boards, and observer's time study forms, are described in a booklet that will be sent without charge. Address Thos. R. Hough Associates, 5337 Belle Plaine Ave., Chicago, Ill.

"Do It Electrically": The complete line of "Thor" universal electric tools, including tools for drilling, reaming, screw-driving, tapping, nut-setting, grinding, and for performing other operations is described in Catalog No. 17, issued free by the Independent Pneumatic Tool Co., 236 S. Jefferson St., Chicago, Ill.

Tool Room Equipment: Jig borers, vertical shapers, die relieving lathes, tool milling machines, button die grinding machines, and other tool room equipment are described in a catalog issued by the Index Machinery Corporation, 49 Central Ave., Cincinnati, O. Copy free upon request.

Special Mil-Waukee-Mills of Standard Units: A milling machine of which the base, heads, columns, and other parts are built in standard units, thus enabling the user to order a machine that will be especially adapted for his job, is described and illustrated in Catalog No. 36, issued by the Kearney & Trecker Corporation, Milwaukee, Wis. Free to machine shop executives.



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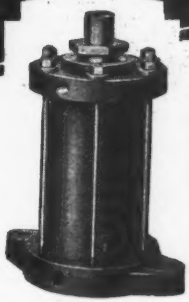

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Koebel-Wagner Diamonds for Wheel Dressing: The Koebel-Wagner method of mounting diamonds and the use of the "Dykon" gage are discussed in a bulletin issued by the Koebel-Wagner Corporation, 144 Orange St., Newark, N. J. Free upon request.

Drill Around Corners: Holes can be drilled in close quarters by the use of the Koza Right Angle Drill. Can also be used for keywaying or countersinking. A descriptive pamphlet can be had by addressing Chas. A. Koza, 464 Augustine St., Rochester, N. Y.

Lathe Dogs and C Clamps are described and illustrated in Catalog No. 80, issued by the W. G. LeCount Tool Works, South Norwalk, Conn. Copy free upon request.

Linley Rotary Rivet Spinners—swift and noiseless—assure peak production and lower maintenance costs on any kind of production riveting. Apply for full details to Linley Brothers Company, Bridgeport, Conn.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Punching and Shearing Mashines of the most modern design are described and illustrated in a series of bulletins that can be obtained without charge by addressing The Long & Allstatter Co., Hamilton, Ohio.

Rapid-Reading Micrometer: A new type of rapid-reading micrometer, designed to show the reading in numerals, is described in Catalog No. 5, issued by The Lufkin Rule Co., Saginaw, Michigan. The catalog also contains descriptions of the micrometers, calipers, gauges, scales, squares, bevel protractors, and other tools made by this company. Free upon request.

"A Captain of Industry:" Pocket Handbook 23-P, issued by The David Maydole Hammer Co., Norwich, N. Y., tells how David Maydole came to make what he considered the best hammer in the world, and also includes descriptions of the various types of Maydole hammers. Several useful tables are included. Copy free upon request.

Time Saving Machine Equipment: How machining time can be reduced to the minimum by the use of Wizard chucks, collets and tap holders, turret tool posts, self-centering steadyrests, and other McCrosky equipment is told in a book that is issued by the McCrosky Tool Corporation, Meadville, Penna. Will be sent without charge.

Midwest Pin Drive Keyway Cutters are described and illustrated in a catalog that can be had by addressing Midwest Tool & Mfg. Co., 2362 West Jefferson Ave., Detroit, Michigan.

Polish at Any Speed: The Mitchell motor-driven polishing lathe, in which herringbone gears are used to transmit power from the motor shaft to the lathe spindle, can be operated at any desired speed. Bulletin can be obtained by addressing the Mitchell Engineering Co., Springfield, Ohio.

Nateo Drilling, Tapping, and Boring Equipment is the title of a publication that has been issued by The National Automatic Tool Co., Richmond, Ind. The book gives details as to construction and uses of "Nateo" multiple drilling and tapping machines.

Milling Internal Keyways: A simple method of milling keyways in gears, wheel hubs, and other similar parts with the aid of a drill press and a special tool is explained in a booklet that is published by the National Machine Tool Co., 2271 Spring Grove Ave., Cincinnati, Ohio.

"The Answer to Your Gear Problems": Information as to correct methods of cutting and finishing gears will be supplied without charge by The National Tool Co., Cleveland, Ohio. This firm also carries a complete stock of gear shaper cutters and markets the National-Cleveland Spur and Helical Gear Grinding Machine.

Save Time with Expanding Mandrels: How expanding mandrels will solve the problem of turning pieces with odd-size holes, and will increase production on duplicate work, is told in a folder that will be sent free upon request by W. H. Nicholson & Son, 136 Oregon St., Wilkes-Barre, Pa.

Live Centers: The complete line of live centers manufactured by Nielsen, Inc., of Lawton, Mich., are fully described in a bulletin issued by this company. This bulletin is illustrated with photographs and blueprints of the Nielsen Center. Mailed free upon request.

Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

How To Grind Cemented Tungsten Carbide: A booklet which describes and illustrates the correct methods of grinding tungsten carbide tools has been published by the Norton Company, Worcester, Mass. Copy free upon request.

Die Making Machines: How dies, templates, gages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

Self-Tapping Sheet Metal Screws: Screws which are threaded and hardened in such a manner as to enable them to cut their own threads as they are screwed into sheet metal assemblies are described in a folder which is published by the Parker-Kalon Corporation, 192-196 Varick St., New York City, N. Y. Sent free upon request.

Powell "Blo-Gun" Air Valves: Air is faster and more efficient than a brush for cleaning machine tables. The use of the Powell Blo-Gun for this purpose is discussed in a catalog that can be obtained by addressing The Wm. Powell Co., Cincinnati, O.

Tapping Devices, Quick-Change Chucks, Stud-Setting Tools and Bench Tappers: A catalog describing the various types and kinds of tapping, drilling, and stud-setting devices manufactured by the Procunier Safety Chuck Company, 12 South Clinton Street, Chicago, Ill., can be obtained without charge by addressing this company. The catalog also tells the part that Procunier tools play in obtaining greater accuracy and less tap breakage.

Engine, Turret, and Gap Lathes are described in a series of bulletins that have been issued by The Rahn-Larmon Co., 2935 Spring Grove Ave., Cincinnati, Ohio.

Shape or Slot With This Machine: The Rhodes Convertible Shaper, made by The Rhodes Manfg. Co., Waltham, Mass., can be used for horizontal shaping or vertical slotting. Details upon request.

Pullmore Industrial Clutch: A multiple disc clutch, made in two types, to run in oil or dry, and which is so built that it can be operated at high speeds, is illustrated and described in a folder that will be sent free by the Rockford Drilling Machine Company, Rockford, Ill.

Hy-Draulic Shaper-Planer: The most modern features are embodied in the design of the Rockford Hy-Draulic Shaper-Planer, which is intended for work that would otherwise go to the small planer or large shaper. Write for folder to Rockford Machine Tool Co., 2414 Kishwaukee Ave., Rockford, Ill.

Automatic Lubrication: Individually motor-driven pumps that keep the work flooded with lubricant are described in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

Safety Grinding Wheels: The complete line of grinding wheels made by the Safety Grinding Wheel & Machine Co., Springfield, Ohio, is described in Catalog No. 11, which is issued by this firm. The book also contains instructions for operating grinding wheels, tables of grinding wheel speeds, pulley calculations, and other information for the user of grinding wheels.

Full Automatic Hobbing: Small pinions, gears, ratchet wheels, and similar parts can be hobbed economically on a full automatic hobber with magazine attachment. For full details write the George Scherr Company, 142 Liberty St., New York, N. Y.

Saving Time With Small Tools: A line of time-saving small tools, including "Use-'Em-Up" drill sleeve, "Wear-ever" chucks, collets, cutters, reamers and tap holders.

Quick Adjustment

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Improved Results

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MIDWEST ADJUSTABLE HOLDER!

The results you get with the use of MIDWEST ADJUSTABLE HOLDERS are three fold. They are:

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The holder can be adjusted instantly by hand. There are no screws or locknuts in the MIDWEST HOLDER. Adjustments in length can be maintained to a limit of .003".

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The MIDWEST HOLDER is built to Precision Limits which assures accurate alignment.

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Designed for quick adjustments — and you get more adjustments in proportion to size than with any other holder—and built accurately means that you can improve your product by working to closer limits.

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Midwest Tool & Mfg. Co.

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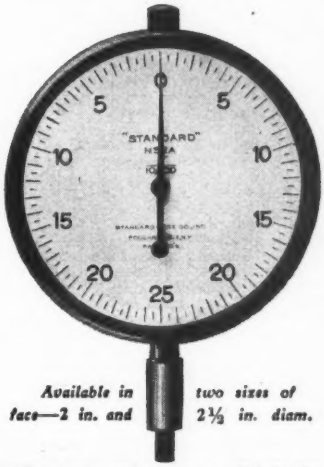
DETROIT MICHIGAN

STANDARD DIAL INDICATOR



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THIS advanced type of Dial Gage is made in a Gage making shop, to the finest of gage standards. Unit construction with the fewest number of parts, all enclosed in dust proof cover. Sturdiness that stands hardest shop. Supremely accurate because new method of cutting gears and rack makes this possible. Available in two sizes, 2-in. and 2½-in. in a full range of graduations. Write for booklet.

STANDARD GAGE CO., Inc.

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I would be interested in receiving copy of your catalog covering your "STANDARD" Dial Indicator.

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counterbores, spotfacers, and other tools is described in Catalog 36, issued by Scully-Jones & Co., 1909 S. Rockwell St., Chicago, Ill.

Equipment For the Shop: Vises for the bench, drill press, milling machine or shaper; angle plates; adjustable clamps, jacks and other tools for the machine shop, are described and illustrated in a booklet that is published by the Sheldon Machine Co., 3253-55 Cottage Grove Ave., Chicago, Ill. Copy free upon request.

Economies in Material Handling: A volume of facts about planned load handling, with actual examples of economies in time, material, and labor costs that have been effected with Shepard electric hoists will be sent free upon request to Shepard Niles Crane & Hoist Corp., 424 Schuyler Ave., Montour Falls, N. Y.

Rapid Drill Jigs: How time can be saved and drilling operations made easier by the use of a quick-acting drill jig is told in a booklet that is issued free by the Slewek Tool & Die Co., 10230 Woodward Ave., Detroit, Michigan.

"Metal Cutting" is the title of the book that describes the latest methods of cutting metals, and includes descriptions and illustrations of both the band saws and inserted-tooth metal-cutting saws made by the Simonds Saws & Steel Co., Fitchburg, Mass. Copy will be sent free upon application to the firm mentioned.

Simplex Nesting Bins: Bins which may be used as individual containers, as tote-boxes, or "nested" to form stock-room sections are described in an illustrated circular published by the Simplex Tool Co., Woonsocket, R. I. Copy free upon request.

Worn Chucks Waste Money: New, modern machines are transformed into old ones by the use of old, worn chucks. Modern chucks are described and illustrated in a catalog that may be had by addressing The Skinner Chuck Co., New Britain, Conn.

The Most Efficient Speed for the operation of special production units, power conveyors, and other machinery by the use of the WHS Speed Reducer and how it can be obtained is told in a bulletin that will be mailed free by Winfield H. Smith, Inc., 30 Eaton St., Springville, N. Y.

A Snyder Tool Set-Up, consisting of a Snyder ball-bearing multiple head, bushing plate, and work holding fixture, will convert a single spindle drill into a multiple drill at small cost. Particulars upon request. Address Snyder Tool & Eng. Co., 3400 E. Lafayette Ave., Detroit, Michigan.

Accurate Gages Speed Production: The complete line of snap, plug, ring, pin, dial indicator, and special gages made by the Standard Gage Co., Inc., Poughkeepsie, N. Y., is described and illustrated in Catalog No. 4, which can be had without charge by addressing this firm. Johansson gage block sets and accessories are also listed in this book.

Machinists' Tools and Gages: Catalog No. 24, issued by the L. S. Starrett Co., Athol, Mass., describes and illustrates the complete assortment of machinists' fine tools and gages made by this firm. Copy free upon request.

Flexible Shaft Equipment: The uses of the flexible shaft for drilling, grinding, and other operations is discussed in a booklet which also describes and illustrates the flexible shaft equipment made by N. A. Strand & Co., 5001 N. Lincoln St., Chicago, Ill.

Rigidmilling Principles and Practice: A book that shows how the Rigidmil can be adapted to various kinds of usual and unusual milling operations, and which describes in detail the work that can be handled by this machine has been issued by the Sundstrand Machine Tool Co., Rockford, Ill. Copy free upon request.

Cutting and Grinding Facts: A discussion of cutting oils and lubricants, together with descriptions and illustrations of various kinds of jobs upon which cutting oils are used, is contained in a booklet that is issued by the Sun Oil Company, Finance Building, Pittsburgh, Pa. Free upon request.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomkins-Johnsen Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

A Simplified and Improved Drive Control for Machinery: Two distinct types of plate clutches that have proved successful highly in the driving mechanism of machine tools are described and illustrated in a bulletin that will be sent free by the Twin Disc Clutch Company, Racine, Wis.

Powerful, Easy-Acting Chain Hoists of the most modern design are described and illustrated in a booklet that is issued by the Union Manufacturing Co., 294 Church St., New Britain, Conn. Copy free upon request.

Multiple Drilling With a Single-Spindle Drill: Methods by which multiple drilling may be done on a single-spindle drill, using multiple spindle drill heads, are discussed in a bulletin that is issued by The United States Drill Head Co., 1954 Riverside Drive, Cincinnati.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, electric screw drivers, surface grinders, tool post grinders, and bench and floor grinders is described in Catalog No. 24, which has been published by The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio.

Income Builder for Repair Shops: A catalog listing over 800 vacuum cleaner parts and special tools, with data on obsolete parts, can be obtained from Uron Associated Industries, 1361 Engineers Bldg., Cleveland, Ohio.

Measuring Threads by Wires: Directions for micrometer gaging of screw threads by the use of wires are given in Circular W26, published by The Van Keuren Co., Watertown, Mass. Copies may be obtained free by addressing this company.

Tool Chests for Machinists and Toolmakers: The complete line of fine tool chests for machinists and toolmakers made by J. M. Waterston, 420 Woodward Ave., Detroit, Mich., is described in Catalog No. 25. Ask for it.

Good Chucks Are As Important As Good Tools: Catalog No. 528, issued by the Westcott Chuck Co., 121 E. Walnut St., Oneida, N. Y., describes and illustrates the line of lathe and drill chucks made by this company. Copy free upon request.

Screw Machine Products: Full information as to the manufacturing service on screw machine products maintained by Western Screw Products Co., 19-31 St. George St., St. Louis, Mo., will be sent upon request.

Wetmore Adjustable Reamers: The exclusive features of the Wetmore Adjustable Shell Reamer are discussed in Catalog No. 29, issued by the Wetmore Reamer Co., 62 27th St., Milwaukee, Wis. Copy free upon request.

Change Punches Without Removing Die: The user of Hercules Interchangeable Punches and Retainers can change punches without removing the die from the press. Information that will help to lower die-building costs, reduce lost time for repairs, and increase press production can be had by addressing Whitman & Barnes, Inc., Detroit, Michigan.

Whiton Steel Body Lathe Chucks: The various types and sizes of steel body chucks for lathes that are made by the D. E. Whiton Machine Co., New London, Conn., are described and illustrated in a booklet that will be sent free upon application to this firm.

Wrenches For Every Use: "Guaranteed Against Breakage" tappet wrenches, pipe and fitting tongs, offset wrenches, and wrenches for all other uses are described and illustrated in a series of folders which can be obtained without charge by addressing J. H. Williams & Co., Buffalo, N. Y.

"An Inspection Tour of Industrial Plants" is a booklet published by Wilson-Maeulen Co., Inc., Concord Ave. & 143rd St., New York, N. Y., showing the heat-treating equipment in use in a number of industrial plants, and discussing the manner in which such equipment is automatically controlled. Copy free upon request.

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"C" CLAMPS

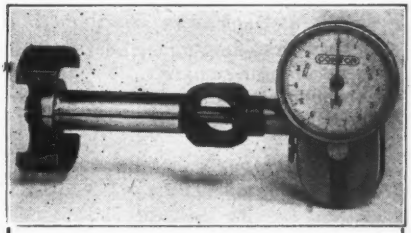
DROP FORGED

Seven sizes, 3 to 12 inches.

13/16" screw. 2½" depth of throat.

Write for Catalog No. 80, showing Clamps, Lathe Dogs, and Expanding Mandrels.

W. G. LECOUNT TOOL WORKS
SOUTH NORWALK, CONN.



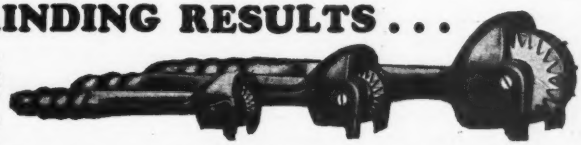
COMTORPLUG

THE Amplifier is graduated to tenths thousandths inch. All sizes of interchangeable expansion plugs are used in it.

Comtorplugs are both self-centering and self-aligning. They instantly and automatically seat in the hole, and give the one correct reading. They are therefore fast and sure. This positive correct seating assures absolute fidelity in the comparator or copying function. Error of wear is completely eliminated. Comtorplug precision, to one half tenth thousandth inch, is not affected at all by months of use.

The Comtor Company
Waltham, Mass.

GOOD GRINDING RESULTS . . .



can only be obtained when grinding wheels are properly dressed and have keen cutting edges.

The Desmond-Huntington Dresser is an excellent tool for keeping every grinding wheel sharp and true, especially wheels where quick action is necessary. *Write for Catalog M.*

THE DESMOND-STEPHAN MFG. CO., Urbana, Ohio

THE SCRAP PILE

By GEO. ALEXANDER MANN

Oh Myrt—You're Turrible

Mabel swears she's never been kissed,
By no man anywhere.
Myrtle asks, "Ain't that enough
To make the poor thing swear?"

I've never seen a wedding that the best man didn't look happier than the groom.

Short and Sad

Here he lies,
Airman Hopp—
His first flight
Was a flop.

A great deal depends upon whether you're out to make a living or a killing.

Another Lie Nailed

Jes' when it had been definitely decided that "women dress to please the men," they don long skirts.

At the Movies

"Could you love me that way?"
Asked his sweetheart, Bess,
An' he answered bluntly:
"At his salary, yes."

'Tis cheaper far to have her on your mind than to have her on your hands.

Gosh, it's sad, Myrtle.
You tell 'em, I stutter.
Are cows fed peanuts,
To get peanut butter?

An' O' Course That'd Be Awful

Then there are the timid, harmless souls who wouldn't think o' goin' abroad an' havin' it said that they "double crossed" the ocean.

Our aim in life is to live so that at seventy we'll be going like sixty.

In mos' ev'ry organization there are those who make the speeches an' those who do the work.

The average man either makes a fool of himself or gives a lotta co-operation to somebody who does it for him.

Dem Shame

Wife bot a can opener,
She's surely in a sweat.
It is too big to get it
Into the kitchenette.

"Would you shoot a man with a wooden leg?"

"Naw, I'd shoot him with a gun!"

"I don't like the looks of that mackerel."

"Well, Madam, if it's looks you're after, why don't you buy a goldfish?"

Sobby But Troo

When it comes to "hootch" wouldst ejaculate that this is a land of "good and plenty." Little "good" and "plenty" bad.

This ANDERSON HAND SCRAPER

***will be sent to you for* 10 DAYS' FREE TRIAL!**

Don't waste time making your own. The blades are of just the right hardness. Cuts faster and lasts longer than any home-made scraper.

Price per doz., ¾", $26.00; 1", $27.00; 1¼", $28.00. ***Let us send you one on trial.***

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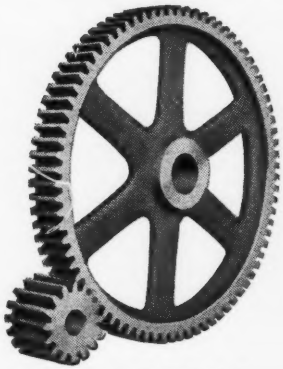
GEARS



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Index to Advertisements

	Page
Abrasive Company, The	60
Acme Machine Tool Company, The	91
American Broach & Machine Co., The	91
Ames Company, B. C.	80
Anderson Bros. Mfg. Co.	113
Angle Steel Stool Co.	103
Apex Machine Co., The	68
Armstrong Bros. Tool Co.	10
Atkins and Company, Inc., E. C.	75
Avey Drilling Machine Co.	71
Barber-Colman Company	27
Barnes Co., W. F. & John	63
Barnes Drill Co.	7
Baumbach Mfg. Co., E. A.	97
Boker & Co., Inc., H.	74
Bonney Forge & Tool Works	Third Cover
Bradford Machine Tool Co.	84
Brewster & Co., Inc., Wm.	78
Brown & Sharpe Mfg. Co.	5
Canedy-Otto Manufacturing Co.	65
Chuck Manufacturers of America, The	33
Cincinnati Grinders, Incorporated	4
Cincinnati Milling Machine Co., The	19
Cincinnati Planer Co., The	35
City Machine & Tool Works	111
Cleveland Twist Drill Co., The	116
Columbia Machine Tool Co., The	83
Columbia Tool Steel Company	113
Comtor Company, The	111
Connecticut Broach & Machine Co.	79
Danly Machine Specialties, Inc.	Second Cover
Davis Keyseater Company	93
Desmond-Stephan Mfg. Co., The	111
Diamond Machine Co.	15
Dumore Company, The	31
Eclipse Counterbore Company	103
Efficient Machine Shop	78
Federal Products Corporation	89
Fellows Gear Shaper Co., The	50
Ferner Co., The R. Y.	18
Formica Insulation Company, The	43
Fosdick Machine Tool Company, The	53
Gallmeyer & Livingston Co.	85
Gardner Machine Co.	55
Genesee Manufacturing Co., The	88
Graham Mfg. Co., The	92
Greaves-Klusman Tool Company	83
Grobet File Corporation of America	113
Hamilton Mfg. Co.	67
Haskins, R. G., Company	89
Heuser Mfg. Co.	97
Hisey-Wolf Machine Co., The	1
Horsburgh & Scott Co., The	113
Hough, Thos. R., Associates	90
Independent Pneumatic Tool Company	26
Index Machinery Corp.	21
Kearney & Trecker Corporation	3
Koebel-Wagner Diamond Corp.	81
Koza, Charles A.	95
LeCount Tool Works, W. G.	111
Linley Brothers Company	95
Logansport Machine Company	66
Long & Allstatter Company, The	105
Lufkin Rule Co., The	87
Maydole Hammer Co., The David	107
McCrosky Tool Corporation	47
Midwest Tool & Mfg. Co.	109
Mitchell Engineering Co., The	93
National Automatic Tool Co., The	49
National Machine Tool Co., Cincinnati, O.	95
National Tool Company	8
Nicholson & Co., W. H.	115
Nielsen, Inc.	98
Norma-Hoffmann Bearings Corporation	First Cover
Norton Company	6
Oliver Instrument Company	97
Parker-Kalon Corporation	39
Powell Co., The Wm.	87
Procunier Safety Chuck Co.	115
Rahn-Larmon Company, The	94
Rhodes Manufacturing Co., The	91
Rockford Drilling Machine Co.	79
Rockford Machine Tool Company	23
Ruthman Machinery Co., The	99
Safety Grinding Wheel & Machine Co., The	25
Scherr Company, George	82
Scully-Jones & Co.	51
Sheldon Machine Company	69
Shepard-Niles Crane & Hoist Corp.	17
Siewek Tool Company	101
Simonds Saw & Steel Co.	57, 58, 59
Simplex Tool Company	99, 102
Skinner Chuck Co., The	81
Smith, Winfield H., Inc.	87
Snyder Tool & Engineering Co.	76
Standard Gage Co., Inc.	109
Starrett Company, The L. S.	2
Strand & Company, N. A.	96
Sundstrand Machine Tool Co.	96
Sun Oil Company	36, 37
Tomkins-Johnson Co., The	107
Twin Disc Clutch Company	29
Union Mfg. Co.	85
United States Drill Head Co., The	101
United States Electrical Tool Co.	Fourth Cover
Uron Associated Industries	82
Van Keuren Company, The	68
Waterston's	115
Westcott Chuck Co.	86
Western Screw-Products Company	115
Wetmore Reamer Co.	73
Whitman & Barnes, Inc.	45
Whiton Machine Co., The D. E.	105
Williams & Co., J. H.	41
Wilson-Maeulen Co., Inc.	77

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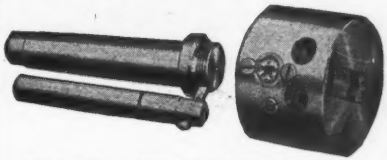

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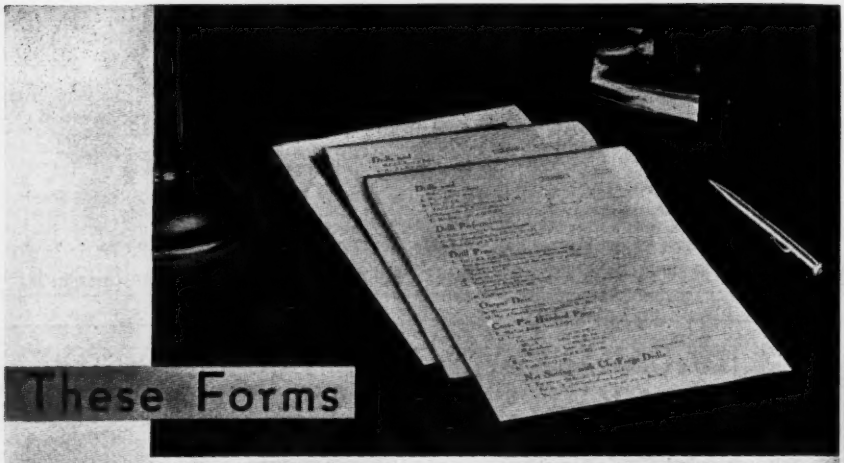

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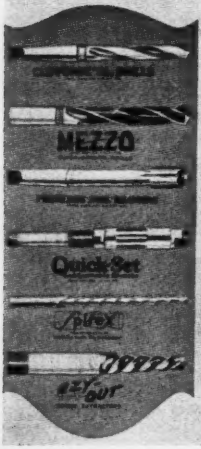

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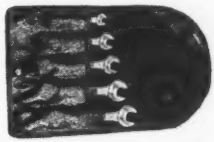

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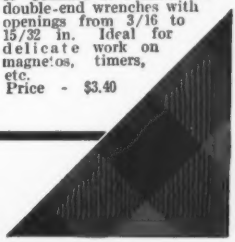

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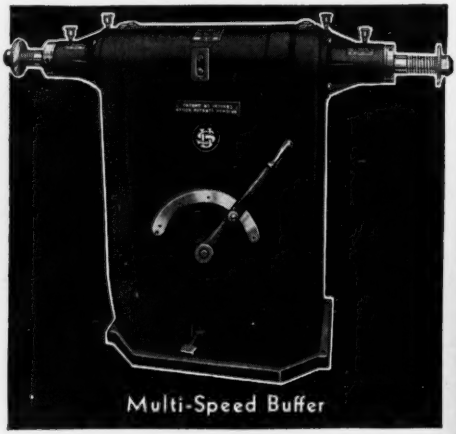
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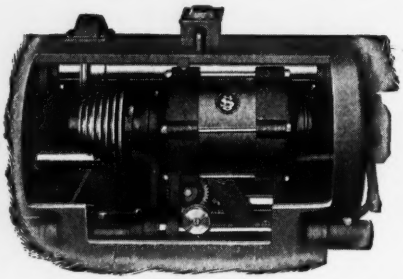
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